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THE

FRANKLIN JOURNAL,

AND

AMERICAN MECHANICS' MAGAZINE;

DEVOTED TO THE

USEFUL ARTS, INTERNAL IMPROVEMENTS, GENERAL SCIENCE,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

UNDER THE PATRONAGE

OF THE

FRANKLIN INSTITUTE OF THE STATE OF PENNSYLVANIA.

EDITED

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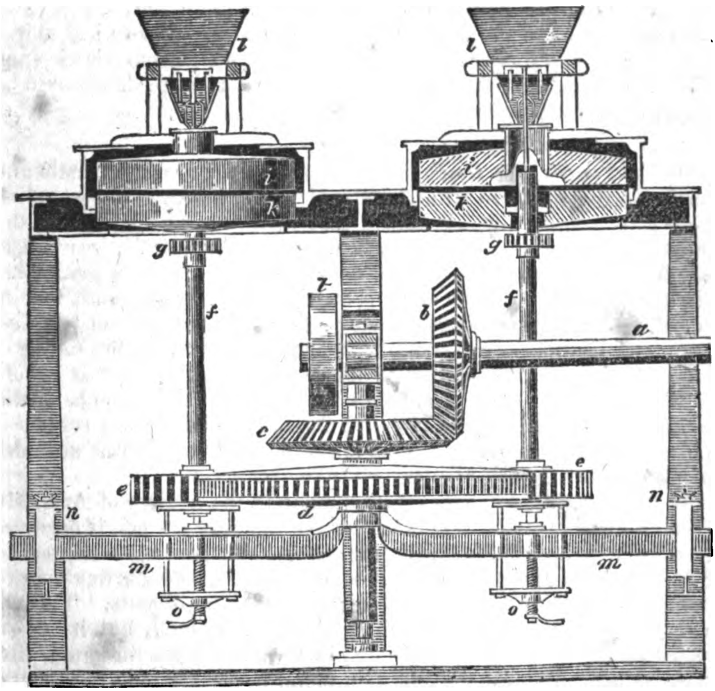
JULY, 1828.

MR. HOBLYN'S MILL FOR HUSKING RICE.



Account of the Island of Ceylon, its Agriculture, and the processes followed in several arts by the natives; with suggestions for their improvement.

[Continued from p. 332, Vol. 5.]

We commenced the account of the arts, &c. in Ceylon in our last volume, by a recurrence to which it will be seen that the British government have encouraged the settlement of Europeans in that island. Mr. Hebert, the editor of the Register of Arts, has made many suggestions for the introduction of improved machinery, and new modes of procedure, which he has interspersed among the accounts of those now used by the Singalese; the present paper consists principally of these, but, in a future number, cuts of many other of the native instruments will be given. Among the machines recommended, will be found Barker's mill, of which the writer appears to think highly, and the *theory* of its action seems to warrant the opinion expressed; it, however, has been repeatedly tried, and as frequently abandoned, and considering the simplicity of its construction, and the directness of its action, which takes place without the intervention of gearing, we are forced to conclude, that it adds one to the list of those *practical* facts which manifest the imperfection of our theories on the motion of fluids: we think, however, that a careful investigation of the subject will furnish strong theoretical objections to this mode of applying the action of water; our views upon this subject shall hereafter be presented more at large than would be proper upon the present occasion.

Our last paper was concluded with a description of the pestle and mortar in common use with the Singalese for husking and pounding their rice. For reducing *hard brittle* substances into powder, the action of the pestle and mortar is very potent, but the pestle and mortar is an apparatus so unsuited for operating upon raw grain, that the late governor-general of Ceylon, Sir Thomas Maitland, was induced, on his return to this country in the year 1812, strongly to recommend, to the Secretary of State for the Colonies, the taking of measures for the introduction of machinery into Ceylon that should be better adapted for the cleaning of rice. In consequence of this recommendation, Thomas Hoblyn, Esq. was officially instructed to superintend the carrying of the plan into effect, which was attended with very satisfactory results.

In an interesting communication made to the Society of Arts, Mr. Hoblyn observes that,—"instead of the *breaking* system, it occurred to me that trituration might be successful; and under this impression I had several experiments tried on grain-mills, and particularly on the sort of mill where oats are husked for making of grits. This answered tolerably well in detaching the outside shell, but it had no effect whatever upon the fine cuticle which surrounds the grain, after this has been removed; it was then found necessary to have recourse

to some other plan to render the grain perfectly white, and after several ineffectual experiments, the mode now practised was that which was fixed upon as being the means of most effectually completing the process.

The mill consists of a strong framing, supporting by columns a platform about twelve feet square, and ten feet high; upon this platform there are placed, at equal distances, four pair of horizontal stones, four feet six inches diameter, driven by wheel-work contained under the platform, and supported by a framing of iron fixed to the columns. The mill is placed at about ten feet from the fly-wheel of the engine, and receives its motion by a shaft coupled on the end of that which carries the fly-wheel, having a bearing from its other end on the framing of the mill; on this shaft is a bevil or mitre-wheel four feet diameter, with cogs, working in another of the same size on an upright shaft in the very centre of the mill; there is also on this upright shaft a spur-wheel, seven feet diameter, working like the last-mentioned bevil-wheel, horizontally; this large wheel has cogs or teeth in its rim, which work into four pinions or small wheels, two feet six inches diameter, fitted on the spindles of the stones, and drives the four pair at once; all this wheel work is so proportioned, that when the engine makes thirty revolutions, the stone makes 84.

The under stone remains stationary, being wedged part into a circular hole in the platform; in the centre is a hole through which the spindles come from below; in this hole a brass socket is fixed to prevent the spindle from wearing, and the upper end of the spindle stands six or seven inches above the stone.

The upper surface of the stone being made perfectly flat and true, and laid quite level, it is punched full of small holes about a quarter of an inch deep, and three-quarters of an inch apart.

The upper stone or runner is prepared in the same manner, and exactly balanced on the top of the spindle, with its under surface fitting perfectly true to the upper surface of the nether stone. The hole in the centre of the upper stone is large, and has a cross fitted in it to form the centre socket which fits upon the spindle, so that between the arms of this cross the grain turned in can fall upon the nether stone round the centre.

The stones being thus prepared, and the mill in motion, the upper stone revolves with great velocity, while the nether stone is fixed; the lower end of the spindle, or pivot, on which the stone turns is planted upon a strong iron lever, which can be raised or lowered by a screw, and by this means the falls of the stones can be adjusted by the miller, either when the mill is in action or motionless, with the greatest possible facility.

The stones are covered by a hoop, or case, which entirely encloses them, leaving a space all round, between the stone and the hoop, of about two inches; on the top of the case is fixed the hopper, which is filled with paddy; it falls through a hole in the bottom of the hopper into a shoot, and is conveyed into the hole in the centre of the upper or running stone; it then falls through the arms of the cross before described upon the face of the nether stone round the centre. The

stones being in rapid motion, the paddy finds its way between the faces of the two stones, which are now supposed to be set at about the length of the grain apart; the grains are carried by the centrifugal force from the centre to the extremity of the stones, and thrown out in all directions into the case or hoop which surrounds the stones; in one side of this hoop is a hole, through which the rice in this state runs out.

The stones should be set, in the first instance, with great care, for if they are too near, the rice will be broken, and if too far apart, the paddy will get through without being touched; but, when set at the right distance, the husk will be completely taken off, and the rice not broken.

One pair of stones will husk from eight to ten bushels an hour with ease; the rice runs from the cases upon a fine sieve kept agitated by the mills; in passing over this, the dust and sand are separated; it then falls into the winnowing machine, which is to separate the husks from the rice; this is done by causing the husk and rice together, as they left the stones, to fall in a gentle stream through a current of air excited by a succession of fans revolving upon an axis, and driven by the engine in its passage through the current; the husk being much lighter than the rice is blown away, and the rice falls into a bin below.

There is one of these machines to each pair of stones, to separate the rice from the husk, in its passage from the stones to the bin; this part of the operation is most completely performed, and keeps pace with the stones.

The rice in this stage of the operation is more or less red, nothing more being done than the separation of the husk; after this, it is taken to the whitening machine, where the inside cuticle or red skin is detached.

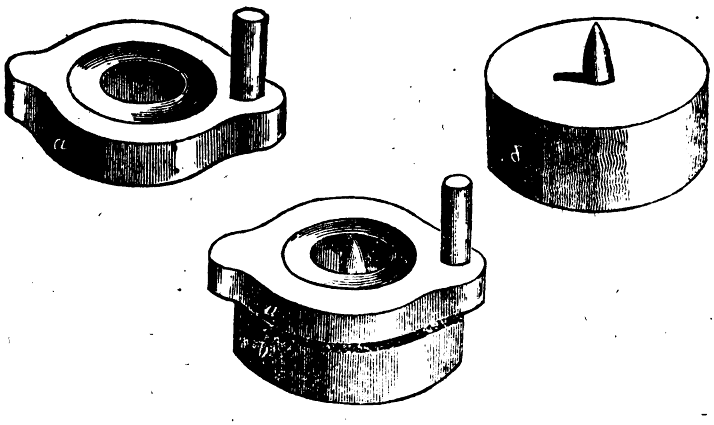
This machine consists of a stone of coarse grit fixed on a spindle like a grinding stone; the stone is inclosed in a box or case made nearly to fit, leaving a space all round of about an inch between the stone and the inside of the case; this case is made of plate iron, and punched full of small holes like a grater, with the rough side inwards; it is so contrived that the case may go round with the stone, or it may remain still while the stone is turning.

The rice is put in between the case and the stone, at a sliding door, or opening in the rim; the space is about two-thirds filled; the stone is then put in very rapid motion, making at least 250 revolutions a minute by a strap; the case is allowed to turn very slowly; this changes the position of the rice; and every grain in succession comes into contact with the stone, and, rubbing hard against each other, an accumulation of heat (which produces an enlargement of the grain, and consequently splits the red skin,) is produced, which serves to loosen the skin; and this, forming a red dust, finds its way out of the holes in the case, and leaves the rice perfectly white.

In the whole process there is little or no loss, for when the stones are well adjusted very few grains are broken, not more, perhaps, than 5 per cent. upon the whole, and those very partially.

Reference to the engraving on the first page.—*a* is a horizontal shaft driven by the steam engine, on which is fixed *b*, a bevil wheel, four feet in diameter; working into *c*, another bevil wheel of the same diameter, which works into four pinions on the spindles of the upper mill stones, two of which are shown at *e e*, each of two feet six inches in diameter; *f f*, spindles of the upper mill stones, having indented pinions, *g g*, near their tops, for the purpose of agitating sieves, which are not shown in the figure; *i i* are the upper mill stones; *k k*, the lower mill stones; *l l*, the hoppers; *m m*, the iron levers on which the spindles of the upper mill stones are planted, and which can be raised or lowered, to adjust the stones, by means of regulating screws, at *n n*; *o o* are screws to raise the pinions, *e e*, and cast them out of gear; *t* is a drum wheel, which works the winnowing machines by means of a strap, not shown. On the shaft, *a*, beyond the limits of our drawing, is placed another drum wheel, which drives, by means of bands, and a multiplying wheel, the two blanching machines before described.

For grinding *corrican* and other small grain, the Singalese use a small stone mill (*corrican galle*) consisting of two parts, *a* and *b*, which are put together as in the underneath figure, and the upper one is then turned by the hand, the grain finding its way between the cup and the central pivot. This simple machine, which (as Dr. Davy observes) has a near resemblance to the old Celtic quern, is, in fact, on the same *principle* as our modern and most celebrated mills, but it is only adapted for grinding small quantities of grain at a time. We, therefore, purpose to exhibit separately several very improved mills, in which the same principle is retained, but modified in such a manner as to produce vastly greater effects. In doing this,



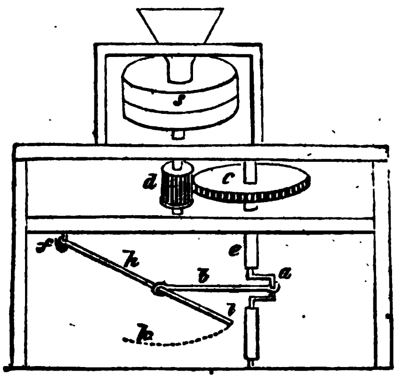
we are compelled to make an arbitrary selection from a great variety of other mills of considerable merit, and such only as strike our judgment to be best calculated to supply the wants of a country like Ceylon, and where the mechanical resources of the natives are, of

course, at present very much limited. For these reasons we shall now confine our attention to *stone* mills, the construction of *steel* mills being probably a branch of art to which the Singalese are at present not equal: besides which circumstance, it is much questioned by practical men whether steel mills are so well adapted for grinding raw grain as those of stone. Be this as it may, we shall in some of our future numbers take occasion to insert descriptions of the best steel hand mills, from time to time, and shall be ready to insert the communications of manufacturers thereupon.

We shall first describe what we will take leave to call

THE ROWING MILL.

The most advantageous mode of applying human strength is similar to that of the ordinary manner of rowing a boat, wherein a man sits upon a low bench, and with his legs extended before him presses with his feet against an inclined board, whilst he pulls back a lever; because in this action the muscular strength of the individual is greatly assisted in the effort by the weight of his body as he throws it back. In Bockler's *Theatricum Machinarum*, there is a description of a mill, wherein this method of applying manual labour is employed, which will be understood by reference to the annexed engraving and accompanying explanation.



The vertical shaft, *e*, carries a toothed wheel, *c*; upon the crank, *a*, hangs one end of an iron bar, *b*, the other end of which is hung upon the lever, *h*, (which may be considered as the oar or scull of the boatman) one extremity of which is hung upon a fixed hook, *f*, so as to turn freely upon it as a centre of motion. Then, while a man by pulling at the end of the lever, *l*, moves it on to *k*, the bar, *b*, acting upon the crank, *a*, gives it and the wheel, *c*, half a revolution; and the wheel, *c*, simultaneously acting upon the small trundle, *d*, gives that and the upper mill stone, *s*, (which is fixed upon the shaft of the trundle) more than a revolution. A momentum is thus given to the mill stone, which it communicates to *d*, *c*, and

a, and the lever, *h*, is thus brought back from *k* to *l*. In like manner another pull at the lever, *h*, causes another rotation, and so on, at pleasure.

In this mill the nearer the end of the bar, *b*, upon the lever, *h*, is to the fixed hook, *f*, the easier will the man work the mill; and by having two or three hooks like that at *f*, fixed at convenient distances, the work of the mill may at any time be adapted to the strength, or the weight, of the individual, by shifting the lever, *h*, from one hook to another.

If the number of teeth in the wheel, *c*, be six times the number of cogs in the trundle, *d*, then the miller, by making ten pulls at the lever, *h*, in a minute, will give sixty revolutions to the upper mill stone in the same space of time.

Where a fall of water can be obtained it affords, with the aid of a little art, the cheapest and the most equable power for driving machinery; for this reason we shall now introduce a description of

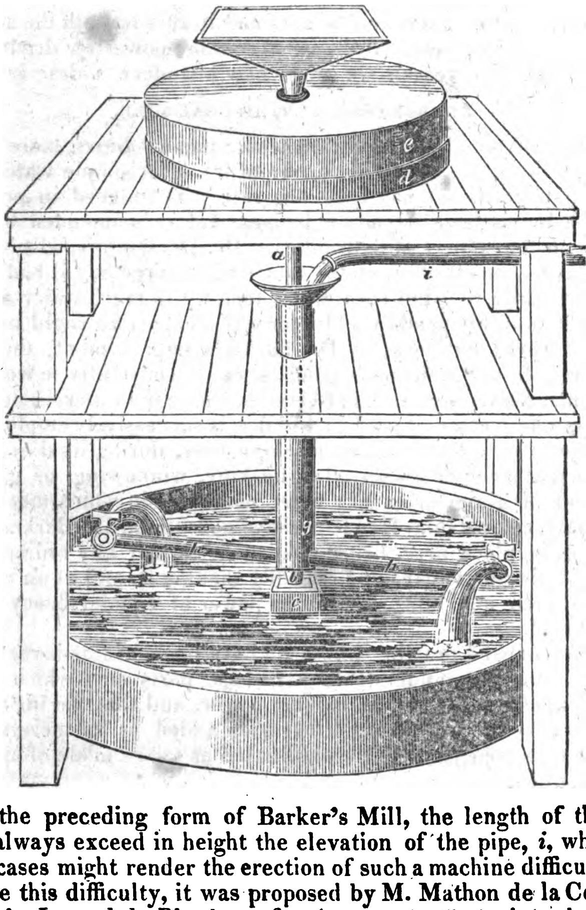
DR. BARKER'S CENTRIFUGAL MILL,

which was invented by the person whose name it bears, more than a century ago; it is, nevertheless, one of the most simple water mills ever constructed. It has been but rarely introduced in practice, although it has been warmly eulogised and recommended by most writers on the subject of hydraulics. Dr. Desaguliers, who published the first account of it, states that "Sir George Savill had a mill in Lincolnshire to grind corn, which took up so much water to work it, that it sunk his ponds visibly, for which reason he could not have constant work; but now, by Dr. Barker's improvement, the waste water only from Sir George's ponds keeps it constantly to work."— In the mountainous districts of Ceylon, where the water, in descending from one terrace of land to another, is successively employed for the purpose of irrigation, this machine may, during its descent, be most advantageously employed in husking, winnowing, or grinding any kind of grain, or in any other operation in which mechanical power might be useful. Hence we have considered Dr. Barker's Mill deserving a place here, being well assured that any ordinary mechanic in Ceylon is capable of readily making it, and at an expense far less than any other hydraulic power of equal efficacy can be constructed.

In the annexed drawing which we have made of this invention, it will of course be understood that those parts only which are in shadow are essential to the moving power, and that the incomplete framed building thrown over it has been added by us merely to assist the comprehension of the uninitiated as to the mode of applying the invention.

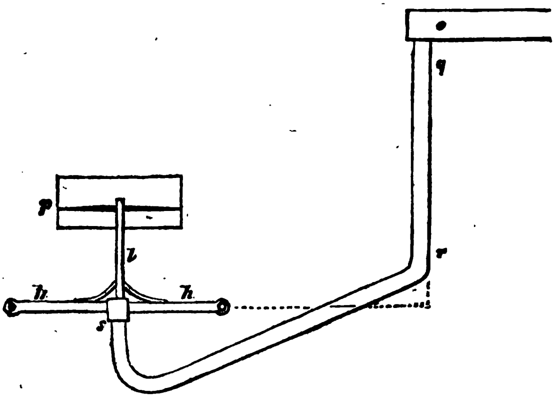
At *a b* is a vertical axis, moving on a pivot at *b*, which would be *best* made of steel, and to run in a brass step let into a block of stone as at *c*; this axis passes freely through the lower mill stone, *d*, and is then fixed to the upper stone, *e*. To the axis is also fixed the large vertical tube, *f g*, the upper part of which, *f*, is expanded into the shape of a funnel or basin, for receiving the water from the mill course or pipe, *i*; at the lower part, *g*, this tube has an open com-

munication with the hollow horizontal arms, *h h*, the extremities of which have each an opening near its extremity on one side, and so adjusted by stop-cocks for regulating the discharge that the vertical tube shall be always kept full of water, in order that the utmost force may be obtained, as a lateral pressure will be produced in all directions in the horizontal arms proportionate to the altitude of the column. Now this pressure being removed from the space forming the area of the aperture in a horizontal arm, by the water being permitted to issue through it, there will be a superabundant pressure on the other side of the arm in which there is no aperture, equal to the force with which the water would spout from the aperture were the machine fixed, and the water permitted to pass through it.



In the preceding form of Barker's Mill, the length of the axis must always exceed in height the elevation of the pipe, *i*, which in some cases might render the erection of such a machine difficult. To remove this difficulty, it was proposed by M. Mathon de la Cour, in Rozier's *Journal de Physique*, for August, 1775, to introduce the water from the mill course into the horizontal arms, *h h*, which are fixed to an upright spindle, *l*, as represented in the annexed diagram,

and without any revolving vertical tube, as in the previously described arrangement.



The water will now obviously issue from the apertures at the extremities of *h h*, in the same manner as if it had been introduced at the top of the tube in the former figure: hence, the spindle may be as short as we please. The practical difficulty which attends this form of the machine is to give the arms, *h h*, a motion round the mouth of the feeding pipe, which enters the arms, without any great friction or any considerable loss of water. In this form of the mill, *o* is the reservoir; *p*, the mill stones; *l*, the vertical axis; *q r s*, the feeding pipe, the mouth of which enters the horizontal arm at *s*.

In a machine of this kind, constructed at Bourg Argental, the tubular arms, *h h*, were each 46 inches long, and their inside diameter 3 inches; each of the orifices 1⅛ inch diameter; the height of the working head was 21 feet above the points of discharge. This, though a great fall, is evidently a very small consumption of water, since it was all supplied by a 2-inch pipe, and when the machine was not loaded, and had but *one* orifice open, it made 115 turns in a minute. Thus a prodigious centrifugal force is produced in the arms, and a corresponding velocity, far exceeding that of a simple fall of water, with a pressure of 21 feet head. The machine, when empty, weighed 80 pounds, and it was half supported by the upward pressure of the water.

On the blowing of Air into Furnaces by a Fall of Water. By the late celebrated William Lewis, M. D.

[Continued from p. 382. Vol. V.]

EXPERIMENTS OF AIR PASSING DOWN THROUGH PIPES WITH FALLING WATER.

Water running through a Crane.

In the running of water through a syphon, or common crane, when the sucking-pipe on the longer leg of the crane was stopped up, the

water, as it issued from the extremity, filled the bore; on opening the sucking-pipe, the column of water appeared less than the bore.

Judging that the motion of the water must be retarded in this last circumstance, I measured, by a pendulum, the times in which equal quantities of water ran through the crane in both cases, and found, in many trials, that the quantity which took the time of a hundred swings of the pendulum to run in when the sucking-pipe was open, ran in ninety-three, and sometimes ninety-two, when it was stopped.

As these differences seemed to proceed from air introduced into the water through the lateral pipe, I tried to make the air sensible, by raising the vessel which received the water from the crane, and keeping the nose of the crane immersed in it. As often as the sucking-pipe was opened, air-bubbles arose in the water of the receiver, and fresh bubbles succeeded while it continued open; but so long as it was kept stopped no air bubbles were seen.

To collect the air, a cask without a bottom was sunk nine or ten inches in a tub of water, and the nose of the crane inserted into a hole made in the top of the cask: into another hole in the top was fitted a small pipe for giving vent to the air, and within the cask was fixed an inverted mortar, for the stream to fall on. So long as water was kept running through the crane, with the sucking-pipe open, a sensible blast issued from the blowing-pipe of the cask, and a burning coal exposed to it was excited in the same manner as by a common bellows; the sucking-pipe being stopped, no blast was perceived, nor was any motion produced in the flame of a candle applied to the orifice.

It appears, therefore, that water, running through an upright pipe, and filling its bore, admits air to enter through a lateral pipe; that, after this admission, the width of the column of water contracts, the introduced air occupying part of the capacity of the pipe, and that this air passes down on the outside of the water, or in a separate column, not intermixed with it, so as to render it frothy.

Water descending through an oblique pipe, with lateral apertures.

I varied the foregoing experiment, by taking, instead of the crane, a leaden pipe, about ten feet long and three quarters of an inch bore. Several holes were made, at intervals, in the length of the pipe, and small tubes fixed into them, like the sucking-pipe of the crane. The pipe being laid aslope, its upper end was turned up perpendicularly, and a funnel fitted to it, which was supplied with water by a cock in the bottom of the reservoir: the other end of the pipe, which the water issued from, was inserted into the air-vessel used in the preceding experiment.

The lateral tubes being stopped, and the cock so turned as to let the water run fast enough to keep the funnel always full, no air issued from the blowing-pipe. On opening the tubes, a considerable blast was perceived; the water passed slower through the pipe, so that the same stream made the funnel run over; and on pulling out some of the tubes, and looking in through the holes, the column of water was very visibly less than the bore of the pipe. The tubes

being stopped again, the blast ceased, and the stream did no more than keep the funnel full.

A small variation in the circumstances of this experiment made a very material difference in the effect. The supply of water having been diminished, so as to rise only a little way above the throat of the funnel, a pretty strong blast issued from the blowing-pipe, though all the lateral holes were closely stopped, and when the tubes were open, instead of air passing in by them, a blast passed out from them, the air-vessel in this case yielding none; so that here the air must have been introduced at the top, and passed down the funnel, and afterwards escaped where it first found a vent. To be further satisfied in this point, I repeated the experiment, with a somewhat different apparatus, in the following manner.

Water falling through a Funnel.

The glass receiver of an air pump, about two feet high, open at both ends, had its lower end immersed about seven inches, in a vessel of water, and supported at a proper distance above the bottom for the free passage of the water under the edges of it.—A brass plate being pressed close on the top, with a leather between, a glass funnel about twelve inches deep, and above half an inch in diameter in the throat, was fixed into a hole in the plate; and into another hole was fitted a small blowing-pipe.

A stopper being introduced into the funnel, till the water it was filled with had become perfectly quiet, and then cautiously removed, the water ran in a stream, which falling into that in the receiver, produced air-bubbles, but no blast issued from the pipe; and when the pipe was stopped, the water in the reservoir did not sink lower than the level of that in the outer vessel; whereas, if any air had entered with the water, and been compressed in the receiver, it must have forced a proportional quantity of the water out below.

The funnel was then supplied from a pipe, by which the water was made to dash against the side of it. By this means, the fluid received a spiral motion, and whirling round the funnel, left a large vacuity in the middle, reaching down, sometimes, to the funnel's throat. The stream as it ran through, was also twisted; a sensible blast issued from the air-pipe; when the pipe was stopped, the water in the receiver was forced lower and lower, and was soon driven entirely out, abundance of air bubbles following it into the water in the outer vessel.

When the funnel was kept entirely full, though the stream was directed against its side, there were little marks of any air being carried down. And when the funnel was nearly empty, the effects were also inconsiderable, the vacuity in the middle of the spiral circumvolutions of the water, seeming to reach to the bottom, so as to suffer the air to escape upwards, through the hollow column of water.

Water falling from a considerable height into a Funnel with a pipe.

A leaden pipe, six feet high and an inch and a half in diameter, was inserted into an air-vessel, with the water-gauge already described. Into the top of the pipe was fixed a tin funnel, whose

throat fitted close to it; and into the funnel a stream of water let fall, from a reservoir five feet above, in quantity sufficient to keep the funnel running over. This apparatus represents Marriotte's blowing machine, before described.

The water divided by the fall, pushed down abundance of air with it: a strong blast issued from the blowing-pipe, and the gauge rose high. On raising up the funnel a little, the stream that issued from it appeared all frothy: as often as the funnel was lifted up, the gauge sunk, the air which had been driven in by the dash of water escaping between the funnel and pipe; on letting down the funnel close, the gauge immediately rose again.

Instead of a fall of five feet, a stream was directed into the funnel, from only about half that height. The gauge still rose considerably, though not so high as before.

It is observable, that in the circumstances of these experiments, a whirling motion communicated to the water in the funnel, impeded the carrying down of air, the gauge always sinking on the water receiving such a motion.—Whereas, in those of the preceding article, it seemed to be by the whirling of the water, that the air was pushed down.

It appears, therefore, that there are two ways, of making air pass down with water through a funnel; one, by directing the stream against the side of the funnel, the other, by letting it fall from a great height: that in the one case the air enters between the spiral circumvolutions, which the water forms in the funnel; and, in the other, between the drops, into which a considerable part of it is reduced by the fall: that we cannot avail ourselves of both ways at once, the one impeding the effect of the other; and, that in either case, the air-holes under the throat, so necessary in other machines, can have no place, as they give a vent to the air brought down from above.

Water falling from a funnel through a pipe with air-holes.

The six-feet pipe, used in the foregoing experiment, continuing fitted into the air-vessel, its upper orifice was widened that the small end of a funnel-shaped copper pipe, of the same bore with the preceding funnel, might hang freely in it, without touching the sides. The funnel pipe reached up to the reservoir, and was kept always full; that the water might receive little or no air, but at the vacuity, between the nose of the funnel and the leaden pipe.

In this situation, the quantity of air was much less than in the preceding; the water fell through the funnel in a stream not at all frothy, and the gauge rose but a little way. I widened the aperture of the leaden pipe to let in more air, but still the gauge continued low.

Into the orifice of the funnel I inserted a smaller pipe, whose diameter was one inch, and whose area was of consequence less than half of that of the leaden pipe. The blast was now strong, and the gauge rose higher than when the water fell from an equal height, into the low funnel of the foregoing article. I tried funnels considerably smaller, and found the gauge still to rise high: but at last, with one

of a quarter of an inch in diameter, it did not rise at all, and no blast could be perceived.

One of the funnels which answered best, being properly fixed, with two or three inches of its neck hanging free within the wider pipe; I made several variations in the manner of admitting the water and air, with a view to compare the effects of different ways of admission. The funnel being full, and gently supplied, so as to keep the water in it as steady as possible, the height of the gauge was marked: on giving a circular motion to the water, or letting it fall from a height, the gauge always sunk, even a slight whirl or dash sensibly affecting its height. The space between the nose of the funnel and the pipe was stopped, so that no air could enter but at the top: the funnel being now full, and the water quiet, the gauge scarcely rose at all; on whirling the water, it rose considerably, and when the water fell from a height, it rose further, though not so high as the standard mark.

It appears, therefore, that there are two general methods in which water may be made to carry down air; one in which it receives the air at the top, and the other through lateral apertures; and the circumstances which contribute to the effect in the one case, impede it in the other: that water, being at rest in a funnel, and then suffered to run through, carries little or no air with it: that when made to whirl round in the funnel, it carries a considerable quantity; and that when it falls from a height, so as to be in part dashed into drops, it pushes down considerably more; that running through a pipe with lateral apertures, perpendicular or obliquely, it receives air through the apertures, even when its motion is slow; that when the pipe is of equal bore throughout, the quantity of air thus received is not great; but that, when the pipe is contracted to a certain degree, in the part where the apertures are, the quantity of air is greater than that introduced through a funnel without air-holes: that air, brought down from the top of the pipe or funnel, prevents the introduction of fresh air through the lateral holes; which, in this case, instead of receiving more air, discharge that already received.

Finding that the two general methods by which air is made to pass down with a stream of water, could not be united in one machine, and that the pipe and funnel, with apertures for the entrance of air, about or under the throat of the funnel, have the greatest effect, I proceeded to examine the most proper form and disposition of these.

EXPERIMENTS AND OBSERVATIONS FOR REGULATING THE STRUCTURE OF THE FUNNEL AND PIPE.

Experiments with funnels and pipes of different heights.

The water, as already observed, passing through the narrow throat of the funnel, is afterwards enlarged into a jet, which fills the bore of a wider pipe. The quantity of air introduced appears to depend upon the degree of this enlargement, and on the quantity of water that runs through in a given time.

The greater the height of water above the narrow throat, the

greater velocity will the jet receive, and the more it will be disposed to spread and be enlarged. The length of the pipe does not appear to be of so much importance; it should seem sufficient, if the pipe is of such length, that the pressure of the water in it may be able to resist the compressed air in this vessel; and that after part of its power has been spent in overcoming that force, it may still have velocity enough left to run down as fast as it can be supplied from the funnel. In order to arrive at some determinable proportions, the following trials were made:

A leaden pipe, seven feet high, and an inch and a half in diameter, being fitted into an air-vessel, as in the foregoing experiments, funnel-shaped pipes, of different heights, were supported over it, so as that the small end of the funnel might hang freely in the orifice of the leaden pipe, and leave space enough for the entrance of air all round. For the greater security of the throat being of the same area in all the funnels, one and the same copper pipe served as a throat for them all: the funnels being formed, by inserting this pipe into larger tapering ones, of different heights. The funnels were always kept full, and the water conveyed into them as gently as possible, so as to produce no dashing or whirling motion.

A funnel of one foot high had very little effect: the rising of the gauge in the air-vessel was inconsiderable, and the stream of air from the blowing-pipe was but just to be felt: on opening some holes made in the leaden pipe, under the throat of the funnel, the jet of water appeared not to spread, but was rather contracted, and did not fill the bore. With funnels of two or three feet the gauge rose more, and the jet spread, though it did not appear to fill the pipe, till it had reached about half way down to the bottom. Funnels about five and six feet high, produced a strong blast, and kept the gauge high, the jet filling the pipe, before it had fallen a foot below the throat of the funnel.

On many repetitions and variations of these experiments, I have not observed that the jet spread sufficiently, with less than a fall of five feet. With a fall of sixty-four inches, the gauge rose more than five times as much as with one of sixteen inches; though the quantity of water which ran in the first case, was only double to that in the latter one; viz., as the square roots of 64 and 16: from whence it is plain that the above differences do not depend entirely on the different quantities of water which run through the funnels of different heights; but, in great part, on its different velocity. Some other experiments seemed to confirm this point: for, having used short funnels, so much wider than the high ones, that the quantity of water discharged by the former, was equal to, or greater than that by the latter; the short funnels never produced so strong a blast, or raised the gauge so far as the others.

Being satisfied of the advantage of having the funnel of a very considerable height, I, in like manner, varied the length of the pipe. Having made a mark at the part where the gauge rose to, when the funnel was five feet long, and the pipe seven, I added to the pipe about a foot more; the gauge scarcely rose any further. A foot

being cut off from it, the gauge fell a little: two feet being cut off, it fell considerably; and the retrenchment of another foot made the machine of little effect, the gauge sinking almost to the bottom, and the blowing-pipe yielding but a weak current of air. The pipe, reduced thus to four feet, was tried with a funnel of near eight feet long; in this case there was no blast at all. But, with funnels, less than its own height, as of two and three feet, it still raised the gauge considerably.

It appears from these experiments, that in most of these machines described in the preceding section, the lengths of the funnels and pipes are greatly disproportioned to one another; and consequently the water applied to disadvantage. Those of Dauphiny in France are particularly faulty in this respect, the funnels being scarcely three feet high, and the pipe twenty-five or twenty-six; with so small a height of water above the choak, I have never been able to make the jet spread near to such a degree, as it is said in the machines of Dauphiny, without particular contrivances for that purpose, which will be mentioned in the sequel of this paper.

The Foix machine agrees the best with my experiments; but, as the funnels of the others are undoubtedly much too low, that of this seems to be rather too high. The effect seems to be the greatest when the funnel is about two-thirds the length of the pipe.

Experiments of the Disposition of the Air-holes.

In the foregoing experiments, the simplest and most obvious way of admitting air was chosen, by leaving a space between the funnel and pipe.

The air-pipes of the machines of Foix and Languedoc answer the same end, carrying in the air above the surface of the jet of water. As the other machines have the air-holes under the jet, I tried what variations would result from this circumstance, and from making the apparatus of different depths, under the throat of the funnel.

Into a pipe of six feet in length was fitted a funnel of four feet; and six inches below the orifice of the funnel four holes were bored round the pipe, sloping down from without, inwards: eight inches lower down, I made another row of holes; and at like distances under these, a third and a fourth. To each hole was fitted a stopper, which exactly closed it.

All the holes being stopped, the funnel was first hung free in the pipe, as in the former trials; and the height to which the water rose in the gauge was marked. The funnel being then let down into the pipe, so as exactly to close it, the upper air-holes were opened; the gauge did not now rise so high as before. The upper air-holes being stopped and the second row opened, the gauge continued at its last height. With the third row open, it rose rather higher than the first mark; and with the fourth, it fell the lowest of all.

The several entrances for the air were then opened by two and two. With the space between the funnel and pipe, and the upper air-holes open, the gauge did not rise so high as with the space only; and with the upper, and second row of holes, it continued at the same height.—With the second and third it rose considerably further,

though not up to the first mark; and with the third and fourth it fell a little below the preceding height. In all these cases, where two rows of holes were open, the water manifestly did not fill the bore of the pipe at the upper holes; but spread so as completely to fill it, by the time it had reached the lower ones: at which last, part of the water spirted out, and carried some of the air with it.

In another pipe of the same size, I made two sets of air holes, three inches apart, and the uppermost of them twelve inches from the orifice of the funnel. With the uppermost row open, and with both rows open, the gauge rose almost equally, being only a little lower in the latter circumstance than in the former; but with only the lower row open, it sunk about one half. These being all stopped, and another set bored opposite to the orifice of the funnel, the gauge rose as high as in the first case.

These experiments, and several others I have made on the same subject, are not so conclusive as I should wish. They seem to show that it is more eligible to have the entrances for the air in one horizontal plane, than in two planes above one another; and either above or at some distance below the jet, than immediately under it: that they ought to be of greater magnitude than in some of the machines described in the first section, particularly in that of Lead-hills, whose air-holes, taken altogether, are not of half the area of the space in the pipe which the air has to fill. They ought, at least, to be of an equal, or rather of a double extent, that the air may enter the more freely.

[TO BE CONTINUED.]

Analysis of Tutenag, or the White Copper of China. By Andrew Fyfe, M. D., *Lecturer on Chemistry, Edinburgh, &c.*

Very different statements have been given of the composition and origin of tutenag, used by the Chinese in the formation of many of their metallic utensils.

According to Keir, it is a white alloy of copper, zinc, and iron, which is very hard and tough, but at the same time malleable, and taking a fine polish. An inferior sort of it, according to the same author, is more of the colour of brass.

De Guigne, on the contrary, states, that its properties, especially that of imparting to copper a white colour, and rendering it less liable to acquire verdigris on its surface, prove that it does not contain zinc. According to him it is an alloy of iron, lead, and bismuth.

Engestroem, in the Stockholm Memoirs, states, that the *Pak-Fong*, or white copper of China, is composed of copper, nickel, and zinc, the last of which amounts to seven-sixteenths of the whole, and the proportions of the two first are to each other as 5 to 7.

Dr. Howison of Lanarkshire was so fortunate, when in China, as to procure a basin and ewer of Chinese or white copper, a part of which he sent me for analysis.

From the experiments I have performed on it, I find the composition to be different from what is stated by the above-named chemists; its component parts being copper, zinc, nickel, and iron; the last of which, however, is but small in quantity.

The basin in the possession of Dr. Howison is of a whitish colour, approaching to that of silver; and is very sonorous. When held in one hand, and struck with the fingers of the other, the sound is distinctly heard at the distance of an English mile: it is also highly polished, and does not seem to be easily tarnished. The piece that was sent me I found was malleable at a natural temperature, and at a red heat; but when heated to whiteness, it was quite brittle, breaking with the slightest blow of a hammer. By great caution, it was rolled into thin plates, and was drawn into wire of about the thickness of a fine needle. When fused in contact with the atmospheric air, it oxidated, and burned with a whitish flame, in the same way as zinc does. Its specific gravity at 50° was 8.432.

Five grains of it were subjected to analysis, with the view of ascertaining the proportion of its ingredients: the result was,

Copper - -	2.02 or in the 100 parts,	40.4
Zinc - -	1.27	25.4
Nickel - -	1.58	31.6
Iron - -	0.13	2.6
	5.00	100.00

The method which is practised in preparing white copper is not known in this country; though it seems to be the general opinion that it is procured by the reduction of an ore, containing the ingredients of which it is composed. In a letter I received from Dr. Howison, he mentions, that Dr. Dinwiddie, who accompanied Lord Macartney to China, showed him, when at Calcutta, several specimens of the ore from which he was told the white copper was procured, and which he obtained at Pekin. The basin in the possession of Dr. Howison cost in China about one-fourth of its weight in silver; and the exportation of utensils of this alloy is prohibited. These circumstances also render probable the opinion that the white copper is obtained by the reduction of a metallic ore; for in China labour is cheap; and the metals composing it are said to be found in great abundance.

[*Edin. Phil. Journal.*

On Various Processes employed in Jewellery. By Thomas Gill, Esq.

The jewellers are in the habit of performing many operations, in the formation of their delicate and beautiful works, in a manner which is highly deserving of adoption in other branches of manufacture. It is with this view that we have determined to lay before our readers some of the more important of these processes; and, first,

On soldering, in jewellery.

In soldering with silver solder, the thinly laminated solder is scraped perfectly clean, and then cut with hand-shears into very small square bits, by first dividing the sheet into narrow slips lengthwise, and then cutting them again across. The lump of borax, which is employed as a flux, is rubbed with water, to a thick consistence, upon a flat piece of black slate, scored all over crosswise, to cause it to act upon, or abrade, the lump of borax the more readily. When the pieces to be joined are ready for soldering, with a small camels'-hair pencil, having a slender ivory handle, flattened at its point, they take up some of the prepared borax, and apply it by means of the pencil, to the parts to be united; they next mix, upon the thumb-nail of the left hand, some of the small square bits, or pellets, of solder, taken up on the hair-pencil, with borax, so as to cover them perfectly therewith: these pellets are then carefully applied, by the help of the point of the ivory handle, to the parts to be soldered: and they are then laid upon charcoal ashes, contained in a small crucible, and are submitted to the action of the flame of a lamp, urged by the blow-pipe; carefully, however, avoiding to heat them too suddenly, or before the borax has ceased bubbling, during the driving off its water of crystallization (which, however, in this mode of employing it, is considerably less than in the ordinary practice,) lest the pellets should be displaced. When the solder has flowed, they very carefully avoid heating the article more, lest it might melt.

In case they wish to prevent the solder from spreading over the surrounding parts, they previously coat them with a layer of Indian ink, applied with another camels'-hair pencil.

In the soldering of filagree-work, the process is different. The gold or silver solders are previously reduced, by filing, to a state of minute division, and are then put into proper small cylindrical metal-boxes, with lids closely fitted to them, and having near their bottoms slender pipes, to allow a little only of the powdered solder to escape at a time, by the action of the finger-nail, rubbed upon a serrated piece of metal, affixed upon the pipe.

The articles to be soldered require to be treated according to their nature and forms. If, for instance, a number of similar twisted wire rings are to be united in a flat circular form, they are to be laid upon a piece of charcoal, sawn and rubbed flat, and are arranged and kept in the required form, by the application of a thick solution of gum-tragacanth, brushed over them and the surface of the charcoal: they are then either laid by, to afford the gum time to dry leisurely; or, if haste prevents that, they must be exposed to a very gentle heat. When dry, the thick mixture of borax before mentioned, must be brushed over them, and the solder be sprinkled upon them in the manner just described: they are then exposed to the action of the flame of the lamp, whilst lying upon the surface of the charcoal;—great care and address, however, is requisite in the management of this very delicate operation, as the least excess of heat would inevitably fuse the whole into a solid mass.

When such an arrangement has been thus formed, and other parts

are to be soldered to it, a solder of a more fusible nature must be employed; and the parts are either to be arranged upon charcoal, in the manner above described, or they may be held and supported upon the branched extremities of a congeries of jewellers' twisted fine iron binding-wire, formed as follows:—Several similar lengths of wire are first twisted together, three at a time, leaving a portion of each untwisted: these are again united together at one end, in three or more sets of three each, leaving their exterior ends at liberty, and, lastly, these combined sets all are united by twisting them together. The mass forms an exceedingly convenient support for the infinite variety of different articles of jewellery, which require to be soldered together; and their union is effected, as before described, by the application of the borax and solder, and exposure to the flame of the lamp.

On the boil, for gold work.

It is a very curious circumstance, that the best workmen in this branch of jewellery have at this day no other menstruum for giving the last high finish in colour to their beautiful articles than the employment of the compound salts of alum, nitre, and common salt, wherewith to form a sort of aqua-regia, or nitro-muriatic acid; instead of employing the nitro-muriatic acid itself:—such, however, is the fact.

They put into a crucible one part, by weight, of alum (sulphate of alumine,) two parts of nitre (nitrate of potash,) and one part of common salt (muriate of soda,) with a very little water; and make it boil over the fire in the forge-hearth. When the salts are dissolved, chiefly in their own water of crystallization, the articles, previously strung upon a platina wire hooked together at its ends, are put into the boil, as it is termed, and frequently taken out from time to time, and washed in water, to see when the proper effect is produced; which is longest in taking place in those parts which are united by soldering.

In this mode, the copper, or silver, which entered into alloy with the gold forming the articles, are dissolved; and the surface of the articles appears of a true gold colour only.

This process, or one differing from it only in the proportions of the three salts, has long since been published in Smith's "*Laboratory, or School of Arts,*" as a solvent for gold; equal parts of each salt being employed: and in this way the Editor succeeded in readily dissolving leaf-gold; the salts becoming tinged of a deep yellow colour, and the fumes of the nitro-muriatic acid extricated most copiously. He also succeeded, by the employment of French brandy, in taking up the gold from its solution, leaving the salts perfectly white; and thus forming, as it were, an ethereal solution of gold. It is, however, most certainly an improvement, to double the quantity of the nitre.

To recover the gold from the washings of the boil.

Strange as it may appear, yet it is a fact, that, till very lately, the jewellers constantly threw away the water into which they had dipped

the articles taken out of the boil, without being at all aware of the quantity of gold they also threw away with it! Latterly, however, a person possessed of more chemical knowledge, has made a considerable benefit by instructing the jewellers, at the price of five guineas each, in the method of recovering that gold which heretofore they had so very thoughtlessly wasted. His process is as follows: The water is put into a large earthenware pan, kept constantly covered, and a solution of copperas (sulphate of iron) is added to it: the gold soon appears, in the form of an impalpable powder; and, when a sufficient quantity is separated (in a week's time, for instance,) and when no turbidness is produced on adding more of the solution of copperas, the water is poured off, and the sediment put by to dry; the sediment being preserved from time to time, until a sufficient quantity is collected to be fused in a crucible, with the addition of nitre to oxidate the iron. The gold is thus obtained in a state of purity.

On forming the gold beads used in filagree-work, &c.

These are made by boring shallow conical holes with a toothed rimer, all over the surface of a piece of flat charcoal; and, according to the intended size of the beads, putting into each hole, two, three, or more rings of gold wire, formed by wrapping the wire around a cylinder of about a quarter of an inch in diameter, and then cutting the helical coil of wire into single rings, each containing a similar quantity of gold, which is the object of coiling and cutting the wire into rings. These being submitted to the action of the flame of the lamp, urged by the blow-pipe, quickly fuse, and unite together into small globular beads.

On melting gold and silver on charcoal, and casting them into shape.

The jewellers avail themselves of the exceedingly slow conducting power of charcoal for heat, to melt a considerable quantity of gold or silver occasionally, without the employment of a crucible, or the use of a forge-hearth or wind-furnace. To effect this, they saw asunder, lengthways, a cylindrical piece of sound charcoal, and rub flat both faces. The charcoal ought to be at least two inches in diameter, and seven or eight inches long. Near the end of one of the pieces, they excavate a hemispherical cavity, large enough to hold the scraps of gold or silver which they intend to melt together with a sufficient quantity of borax to flux them. Between the two prepared surfaces of the charcoal, a flat piece of copper, or other proper metal, is then put, of a thickness equal to that of the mass to be cast, and having a cavity made in the end of it, of the shape to be given to the gold to be cast, and opening at the end, outwardly: this is smoked all over, by being held over the flame of a lamp, previous to its being placed between the two pieces of charcoal; and the whole is bound firmly together with iron binding-wire.—It should be observed, however, that, previously to placing the metal mould between the pieces of charcoal, a slit or channel must be cut, leading from the hemispherical cavity in the charcoal to the mouth of the mould.

When all is ready, the flame of the lamp is directed, by means of the blow-pipe, upon the gold or silver in the cavity; and the heat continued until the metal is melted; when, by inclining the charcoal, it flows directly into the mould.

A variety of moulds are of course provided; and thus small quantities of gold or silver are cast into various forms, with great convenience.

Of the Jewellers' Lamp.

This is of a very simple and convenient form, being made on the principle of the bird-fountain; that is, having an air-tight reservoir at its back, to hold a supply of oil, and a cup to receive it; and always containing an equal depth of oil, which is regulated by the situation of the hole made at the bottom of the reservoir, where the oil enters the cup. In the front of the cup, a spout is fixed to receive the cotton-wick of the lamp, which is of the thickness of a finger. The front of the spout forms a tube; but the back of it is open at the top, for the purpose of pushing the wick outwards, by means of the beak of the blow pipe, when the lamp is to be used; or of retracting it nearly within the end of the spout, to keep it merely alight during the time it is not in use, and thus avoiding a useless waste of oil. This lamp is supported upon a stand or foot, of a convenient height for use.

[*Tech. Repository.*

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*On the Affinage (or Refining) of Gold and Silver, in France.**

In the arts, the name of *affinage* (or refining) is given to the purifying of different substances; but this expression is more especially employed to designate the purification of gold and silver.

In many of the employments of gold and silver, it is necessary that these two metals should be in a state of absolute purity, because it is only then that they possess the malleability requisite for the purposes they are designed for. The leaves, so light and thin, which the gold-beater obtains by hammering, are the product of a metal entirely free from copper; the smallest portions of alloy communicates such a hardness to these two metals, that it becomes impossible to give them that extreme degree of tenuity which is necessary in many of the arts. Gold and silver do not waste in this process, because they possess nearly the same degree of malleability; but the great difference which exists in their respective values, renders them not capable of being sold in commerce, until after they are completely separated the one from the other, and which is the principal aim of the refiner.

If the alloy which is proposed to be refined contains only gold, with silver, or copper, it becomes useless to submit it to a preliminary purification; but as it almost constantly happens that the fused masses contain tin, and often even lead, acquired in the operation of refining,

* Translated from the *Dictionnaire Technologique* for the Technical Repository.

we are obliged previously to free these matters from the least remains of all the foreign metals, leaving the two only to which we give the title of fine, so that we have only to perform the subsequent operation of separating the gold from the silver. This first purification is termed *la poussée*, because its effect is to *push* the refining as far as possible. I will now describe in what manner it is performed. We commence by ascertaining, by means of the process known by the name of *assaying*, the real title under which the matters submitted to the operation have to be considered: if the gold predominates sufficiently to form more than a fourth part of the alloy, they determine the proportion of silver necessary to be added to perform the process of *quartation*. It is indispensably necessary thus to increase the quantity of silver; as we have always observed, that when the alloy contains a less portion, it is in some way defended from the action of the acids by the gold; whereas when the alloy is formed of at least three parts of silver to one of gold, the acid easily penetrates the whole substance of the mass, and extracts even the smallest portions of silver. These proportions being well determined, we place a good earthen crucible in the midst of charcoal in a wind-furnace, and give it a good red heat; we then put into the crucible as much of the mass as, on being fused, will nearly half fill it;—we generally fuse from 15 to 20 marcs at once. As the metal is ready to fuse, we add half a pound of nitrate of pot-ash; we then close the crucible, and cover it with charcoal. At this time the heat must not only be sufficiently intense to fuse the alloy, but also to effect the decomposition of the salt-petre, and the oxidation of the baser metals; it produces a considerable ebullition, sufficient to effect the disengagement of the gas which is then formed; and it is on that account that the crucible should only be half filled. When the matter is perfectly fused, which is known by stirring it with an iron rod, we augment the fire; and the fusion having become tranquil, and the scoriæ entirely separated, the crucible is withdrawn from the furnace, and left to cool: it is afterwards broken, and we find a homogeneous button, which we detach from the scoriæ with which it is covered. These scoriæ contain much caustic potash, and are powerfully affected by the humidity of the atmosphere. They contain also the oxides of copper and tin, and sometimes of lead and iron; we also find in them a small quantity of an alloy of gold mixed with silver: all these scoriæ are put aside; and when a large quantity is collected, they are fused with charcoal powder, and the alloy obtained is submitted to *cupellation*.

The mass of gold and silver which is produced by the *poussée*, is fused anew, and reduced into grains by being poured into a vessel of water, at the bottom of which a copper vessel is placed. We thus divide the metal, to cause it to present a greater surface, and to facilitate its solution; and we therefore endeavour to obtain it in the smallest grains and thinnest leaves possible, which is readily done by pouring the metal into the water, from a certain height above it, taking care that the thread of fused metal should be as small, and as much continued as possible. We raise the basin which contains the

grains, decant the water from them, and dry them over the fire. We finally distribute these grains into glass matrasses with broad bottoms, earthen bottles, or vessels of platina, which we place in a gallery furnace, and pour into each vessel two or three parts of nitric acid, at 30° or 35°: we slightly heat them, to facilitate the action of the acid; the acid is soon decomposed, nitrous gas is disengaged, and the solution is effected. When the effervescence has ceased, we decant the fluid, and pour on a small quantity of fresh acid: it is again heated almost to ebullition; we decant afresh, and then add a third and last portion of acid, but more concentrated, and which is also made to boil. The silver will then be completely dissolved, and the gold will remain at the bottoms of the vessels in the form of powder, or in small masses of a yellowish brown colour. We wash the gold well, and re-unite it in crucibles, where it is fused, adding to it a little nitre: this is what is termed gold of *depart*. To obtain the silver contained in these solutions, we pour them into large earthen vessels, and plunge into them plates of copper: this metal is dissolved in the acid, and the silver deposited in the form of crystallized masses, more or less compact, according to the greater or lesser degree of concentration of the acid. To judge when the operation is entirely terminated, we pour some drops of a solution of marine-salt, in a small proportion to that of the fluid. If it remains limpid, all the silver is separated: lastly, this powder is washed, until the water it is washed in is no longer coloured blue by the volatile alkali. We fuse the silver with a mixture of six parts of saltpetre and one part of borax. When the matter is in tranquil fusion, it is poured into an ingot mould, which had previously been greased: when the ingot is cold, it is plunged into water, to separate the saline particles which adhere to it.

The silver which is thus obtained, when the operation is conducted with care, serves anew for *quartation;* but it is not in the most pure state; it contains some atoms of copper, from which it is readily freed by *cupellation.*

The precipitation of the silver by the copper is effected in a longer or shorter time, which is regulated by the quantity of fluid on which we operate, its degree of concentration, the thinness of the leaves of copper, and the temperature of the atmosphere. When we operate upon considerable quantities, we may withdraw a portion of the solution of copper; and as it contains a large quantity of water, we concentrate it in an open vessel, such as a copper basin, or, which is better, a vessel of platina. The concentrated fluid is finally put into earthen cucurbits furnished with heads, and placed in a gallery furnace; we adapt their receivers, lute the joints with clay, heat them, and distil to dryness. M. Vauquelin advises us to separate the acid which is obtained into two portions: the first which is collected serves for the process of the *depart;* the second part remaining in the retort. This *aqua fortis* is very pure, and does not need to be purified by precipitation, like that which is ordinarily sold. I believe, notwithstanding, that it contains nitrous gas, which renders it improper for the use of the assayer. We find remaining in the cucurbits a brown

powder, which is the oxide of copper: to reduce it, we mix it with an equal part of black flux, and fuse it in a crucible.

Many able metallurgists have thought that the gold of the *depart* retains a little silver; and M. Lesage had shown that this gold, dissolved in the nitro-muriatic acid, threw down a precipitate, at the end of several hours, consisting of a small quantity of muriate of silver. He also thought that the silver of the *depart* retained a small portion of gold. These ideas engaged the attention of M. Dizé, then refiner in the mint, and caused him to seek for other processes which might furnish more exact results; and, after numerous experiments, he found that the sulphuric acid offered great advantages in this respect, because that by using it he discovered in the silver minute quantities of gold, by the means which we shall now describe. The process used by M. Dizé is brought into use, and actually employed in the large, in many establishments at Paris. When new masses of silver are brought to these refineries, they extract from them a portion of gold, which would otherwise be entirely lost. They estimate this portion at a thousandth part of the total weight of the silver, which is nearly equal in value to thirty-five thousand francs, for a thousand kilogrammes of silver. If we calculate how many thousand kilogrammes of silver are annually employed in money, commerce, and the arts, we shall be convinced of the great quantity of gold which is thrown into circulation at a total loss. The process, as now performed, consists of five different operations, which we shall now describe.

1st Operation.—Upon several furnaces, of one foot each in diameter, are placed vessels of platina, of an oval form, each of which receives about 3 kilogrammes of granulated silver, on which is poured 6 kilogrammes of concentrated sulphuric acid. Each vessel is covered by a cone of platina, having at top an opening of about 4 lines in diameter, to allow the vapours to escape. They adapt to each orifice a pipe of platina, or a tube of glass, which conducts these vapours to a condensing apparatus. These furnaces are placed under a hood, to receive and convey away the fumes, which nevertheless escape.

In the cold no action takes place; they are obliged to commence it by the help of heat, and then a portion of the acid becomes decomposed, yields its oxygen to the metal, and is transformed into sulphurous acid gas, which is disengaged. As the silver is oxided, it combines with another portion of the acid, and forms a sulphate, which remains in solution. The solution is brisk, and the disengagement of the sulphurous gas abundant, during the two or three first hours only: after this, the progress of the operation goes on much more slowly, and it is not until the end of about 15 hours that all the metal is acted upon.

During the whole course of this operation not only is the sulphurous gas disengaged, but also the sulphuric acid; and for this reason a much more considerable quantity is employed, than combines in the decomposition: it is consequently essential to be able to guard against the corrosive action of these vapours; and therefore they are careful to place, in the funnel of the chimney, a furnace, to create a rapid

current, and carry them off; and we should also prevent, as much as possible, these vapours from spreading abroad; and it is very probable that means will be found to condense them. I think that, after having caused them to ascend perpendicularly, to disembarrass the workmen, it would be well to direct them laterally into a refrigerator of lead, which might condense the sulphuric acid, and allow only the sulphurous acid to escape; and even this might be easily absorbed, by making it pass through wooden vessels, containing lumps of lime slightly moistened.

2nd Operation.—When the sulphuric solution is finished, it is drawn off into vessels of platina, and diluted with water till it marks from 15° to 20°. We must then allow the small portion of brown powder which remains undissolved to fall down completely;—this is the gold which was contained in the silver. We decant, wash, and finally precipitate the solution of silver with plates of copper, as before described for the nitric solution. We wash very carefully the silver powder which is deposited.

3d Operation.—The silver precipitated in the preceding operation is fused in a crucible, and poured into an ingot mould.

4th Operation.—We treat the gold powder which has been separated, in the same manner, and add to it a little nitre to free it from the small portions of copper which may still remain in it.

5th Operation.—As the sulphate of copper has many uses in the arts, it is easy to procure it from the solutions which are obtained in this new process: when all the silver is precipitated, we evaporate and cause the salts to crystallize; we separate the largest crystals from the smallest, and re-dissolve the latter, to make them crystallize anew.

This is the process of refining actually in use. It remains to be shown, however, that the advantages which it offers are attended with some disadvantages, as there exist in these operations certain sources of waste, which may occasion considerable loss. For example: when we fuse a mass of silver, it frequently happens that the crucible is broken, and whatever care may be taken to collect the ashes, there is always a little deficiency. Every new crucible, also, which is used, imbibes a certain quantity of silver:—in truth, these, with all the fragments, are collected, and added to the ashes from the furnaces, to be afterwards treated in the manner of reducing silver ores: but we are here again subjected to new expenses, and the whole quantity of silver is never recovered. R.

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*On the Uses of Albumen.**

Albumine (albumen) is a product which is found in very great abundance in the animal economy, forming the essential base of many animal fluids; such, for example, as the white of eggs, the serum of

* Translated from the *Dictionnaire Technologique*, for the Technical Repository.

the blood, the sinovial fluid, &c. This substance does not form the immediate object of any manufacture, but is of great utility in certain of the arts. Amongst the properties it possesses, we shall point out those which are most useful. Albumen readily dissolves in cold water; but heat and acids coagulate and so modify it, that it becomes totally insoluble in this vehicle. It is, nevertheless, susceptible, like other animal substances, of being combined with certain astringent and tanning matters, and of forming with them insoluble and imputrescent substances. Alcohol likewise separates it from its solutions, when they are not too much diluted.

The mention of these characters suffices to show in what manner it acts under divers circumstances in which it is employed, and more particularly in the clarifying of liquors.

When it is used to clarify a liquid which does not contain any principle susceptible of being combined with albumen, and rendering it insoluble, we have recourse to the action of heat; and in order that the albumen may act more uniformly, it is previously diluted with a small quantity of water, or of the liquid to be clarified; we then add this solution to the remainder of the liquor, and submit it to ebullition. The albumen coagulates by the augmentation of temperature; and as it is equally diffused throughout the whole mass of liquid, it seizes and entangles all the insoluble molecules, which by reason of their extreme tenuity remained in suspension in the liquid; these very minute molecules, or particles, become thickened by the addition of the albumen, and on that account it is not possible for them to pass the filters, which before would have allowed them to escape.

The same effect is produced, but for another purpose, in the cold clarifications, by albumen. Wine, for instance, contains a tanning substance, and acids in an uncombined state. The albumen being beaten up and combined with these principles, becomes concreted, and in its separation from the remainder of the liquid, it draws down all the matters in suspension, giving them more density, and determining their precipitation. Clarified wine, however, sensibly loses its astringency and acidity, and also a portion of its colouring matter, which is carried down by the albumen.

The viscosity of albumen likewise renders it useful for many other purposes. Confectioners, pastry-cooks, &c. use it, to give both lightness and whiteness to certain articles. They form it into an exceedingly white froth, by agitating it briskly with small brushes or whisks. In this manner they incorporate with it a great quantity of air, which is retained or enveloped in the albumen. This froth, mixed with paste, and beaten up with it, adds lightness to it, by introducing the air which it contains; it also gives whiteness to the articles, by more minutely dividing their molecules.

In all clarifications in the small way, the albumen of the egg is mostly used; but when large quantities are operated upon, as in sugar-refining, they use the serum from the blood of the ox, when they can procure it quite fresh, as, otherwise, it communicates to the sugar a disagreeable taste.

Finally, albumen is also used as an excellent cement. In the laboratories they often cover the lutings of their apparatus with small bands of linen, dipped in powdered quick-lime, and the whites of eggs. This kind of luting renders the joints impermeable to the most subtile gases. An analogous preparation is likewise used to cement broken porcelain and glass.

In addition to these important applications of albumen, we may add its great value in book-binding, as a varnish for the leather covers. And also, that a letter closed or cemented with it, is not to be opened by the steam of boiling water, as when closed by a common wafer; the heat only adding to its firmness. The white of eggs beat up with water is likewise used by sign-painters, to cover over the oil paint intended to be gilt, to prevent the leaves of gold from adhering where gold size has not been laid on.

[*Editor Tech. Rep.*

On Improvements in Gas-Lighting. *By* Thomas Gill, *Esq.*

We are glad to find that Mr. Reuben Phillips's improved mode of purifying coal gas is getting into use; he effects it by passing the gas from the retorts through a number of beds or thin layers of lime placed upon sieves laid one upon another, the lime having been previously brought to such a state, by adding more water to the hydrate of lime in powder, that it is found to adhere together, on grasping a handful of it, and can thus be spread over the sieves, leaving interstices between the coherent parts, sufficient to afford a free passage to the gas through the different layers contained in the sieves. The sieves are piled upon one another to the number of perhaps ten or twelve, each sieve having a water-joint around it, into which a rim, descending from the one above it, enters, and thus renders the joinings gas-tight. The gas, after passing only once through the lime in a pile of these sieves, is found to be sufficiently purified, and, indeed, is in danger of losing a portion of its illuminating power from being over purified. We have seen the lime after having thus performed its office, thrown out of the sieves, in the form of spherical masses, coloured yellow, green, pink, &c. and heating, and giving out steam, arising from the ammonia in the lime combining with the water in the air. This lime is found to be capable of making a good mortar, with the addition of an equal quantity of fresh lime.

By this method, the labour of turning the agitators, which are necessary in using the cream of lime to purify the gas as usual, is entirely saved; and the great nuisance arising from the stench of the impure cream of lime, removed from the washers, mixed with sulphuretted hydrogen, ammonia, &c. is completely obviated.

In those establishments, however, where the gas-washing apparatus is employed, great improvements in the use of it may be made,

by adopting the judicious system introduced by G. Lowe, Esq., in the chartered company's gas works, in Brick-lane, Old-street. Instead of suffering the above nuisance to continue, as was the case previous to his undertaking the superintendence of the works, he now evaporates the impure cream of lime, to the consistence of a thick mud, by putting it into cisterns, formed in the ash-pits of the retort ovens; and thus he not only increases the effect of the fuel contained in the ovens, by passing the steam from the evaporating water through them, but he finds that the cast-iron furnace bars will last a much longer time than before he adopted this plan. When the mud is thus formed, he spreads it over the tops of the retort ovens, and completes the drying of the lime. In this state it becomes so caustic, that the workmen who employ it in luting the mouths of the retorts, are obliged to wear gloves in order to protect their hands from the effects of its corroding action upon the skin.

Mr. Lowe lately exhibited to us, the mode he has also adopted of converting the coal-tar made in the Brick-lane works (which has accumulated in the Peter-street gas works to an enormous extent) into fuel, whereby to assist in heating the retorts. Through a hole made in the tar main above, he causes the tar to descend in a thin stream, into a funnel, fixed into the top of a bent iron pipe, which passes into the retort oven, through a small hole made in its front; here it is delivered upon the red-hot coals contained in the furnace, and is instantly converted into a bright flame, by which the retorts are uniformly heated from end to end in the most complete manner. Here again he has converted what was a nuisance, into an advantage.

In the new retort-house, erected at the Brick-lane works, under the superintendence of Mr. Lowe, he has greatly increased the comfort of the labourers employed in charging and emptying the retorts, by having only one row of ovens erected therein, and ventilating the house, by forming in the wall, opposite to the fronts of them, windows or other openings. The workmen thus, instead of being placed between two fires, as is the case in the retort-houses, as usually constructed, here perform their laborious duties in comparative comfort.

An intelligent friend informed us recently, that in the gas works at Ghent, in Flanders, where, in consequence of the high price of coals, they were obliged to extract gas from rosin, and had adopted Mr. Daniel's process for that purpose, the retorts were destroyed in so short a time, that the expenses of replacing them would have been enormous. In this predicament, and after frequent complaints had been made to him, Mr. Daniel resolved upon taking Mr. Lowe with him to Ghent, where they found the fact to be as represented. On investigating the cause of this evil, Mr. Lowe found that the retorts were destroyed not so much by the action of the fire upon them, as by the corrosion of the *pyroligneous acid*, extracted from the rosin, in converting it into gas. Mr. Lowe provided a remedy for this mischief, in the employment of lime to neutralize the acid.

The same friend also mentioned, that he had seen at the workshops of a manufacturer of gas lanterns, in London, the head of several which had been corroded so nearly through, by the action of

the sulphuric acid and water upon them, which is extricated in the combustion of the ordinary coal gas, that the finger could be passed through them with the greatest ease; and this effect had been produced in a very short space of time. The Editor, on calling upon the manufacturer to ascertain the fact, found it to be as stated; the iron being converted into rust, and nothing left but the outward coat of tin, and the paint with which it had been covered.

The foreman stated that this was a very common occurrence, and was entirely caused by the maker of the lanterns neglecting to paint the *inside* as well as the *outside* of the covers with oil-paint; and which his employer constantly made it a point of doing, not only on first sending them out of his manufactory, but he also periodically renewed the painting afterwards; and that in this way, and by this cheap and simple expedient, the lanterns were made to endure for a considerable length of time. [*Tech. Rep.*

On an effectual cure for Smoky Chimnies. By Mr. S. Mordan.

Mr. Mordan, the patentee of the ever-pointed pencils, showed the Editor lately his contrivance for preventing his kitchen chimney from smoking, and also for quickly exciting his fire, without the aid of bellows.

His fire-place, like many others, had a wide open chimney to it, and was continually annoying his family by smoking. He determined, therefore, to contract the throat of his chimney in the following judicious manner:—He caused the entire opening at the bottom or throat of the chimney to be closed up, with the exception of an upright flue, just above the top of the grate, about a foot wide and high, and which led into the chimney. To the face of this flue he applied a square flat frame of wrought-iron, having upright grooves made on each side of it, in which a sort of hood, made of sheet-iron, could slide up and down. This hood is open behind, and projects about a foot square in front of the chimney back, over the fire-place or grate, and is sloped off at its top, towards the back of the chimney, and it has a handle in the front of it to raise and lower it by.

When the hood is elevated, it serves to guide the smoke and heated air into the upright opening leading into the chimney, its sides being closed to fit the upright back of the fire-place; and the fire then burns in the usual manner, but the chimney never smokes. When, however, he wishes to excite the fire at any time, he lowers the hood until its bottom nearly reaches down to the tops of the cheeks, or two keepers of the grate, and the fire, by the draught thus caused, instantly revives. In addition to this hood, he likewise occasionally hangs upon ledges, formed upon each side of it, an appendage made of sheet-iron, which lengthens it so that its sides fit close upon the tops of the keepers, and thus the air can only gain access to the fire through the front and bottom bars of the grate, and then, indeed, the fire burns most vehemently. [*Ib.*

On the Preparation of Hemp and Flax without Water-Retting. By M. Nicolas.*

In order to avoid the evils of water-retting, M. Nicolas, after having accurately analyzed hemp, proposes to obtain its filaments, as well as those of flax, by simply exposing the plants to the action of the dew (dew-retting;) he remarks that the process is practicable every where, and that it does not give any offensive smell to the hemp, nor injure its quality. This easy process is already employed in the Department of the Vosges, where, beyond doubt, it was first practised; and M. Nicolas, in now pointing it out to notice, proves that it has been overlooked in the modern improvements of the art; and finishes, after his successful experiments, by reverting to the fact, that it is the very means indicated by nature.

M. Nicolas, however, afterwards employs an active and cheap solvent to free the hemp from its gummy resinous parts, which resist the action of the dew. He puts into a tub one hundred pounds of the filaments, bound and tied into bundles or handfuls; and to bleach the fibres he makes a mixture of fifty pints of spring water, to which he adds two pounds of potash; when the solution is effected, he adds four pounds of common oil, and by the assistance of heat, forms a saponaceous liquid, marking about twenty degrees of the areometer, and which he then pours upon the hemp in the tub. He withdraws this lie in two days' time, and heats it to eighty-five degrees of the centigrade thermometer, when he again pours it upon the hemp. On the third day he rubs the filaments between his hands, to wash them thoroughly; and lastly, dries them. In this process the fibres become soft, they make but little tow, and are very readily spun. [*Ib.*

On preserving Wines in Draught. By M. Imery.†

M. Imery, of Toulouse, has given us the following simple means of preserving wine in draught for a considerable time; it is sufficient to pour into the cask a flask of fine olive oil. The wine may thus continue in draught for more than a year.

It is by a similar process, that they preserve wine in Tuscany, which they are accustomed to keep in large bottles, the glass of which is too thin to resist the effect of corking them tight. The oil, spread in a thin layer upon the surface of the wine, hinders the evaporation of its alcoholic part, as well as prevents it from combining with the atmospheric air, which would not only turn the wine sour, but also change its constituent parts. [*Ib.*

* From *Mémoir de la Soc. Royale de Caen*, and Ferussac's *Bulletin des Sciences Technologiques.*

† From *Journ. des Science Usuelles*, and Ferussac's *Bulletin des Sciences Technologiques.*

On Bleaching Sponge. *By* M. Vogel, *of Munich.**

Although sponge, in its chemical nature, very much resembles silk and wool, yet it cannot be bleached in exactly the same manner as those substances. M. Vogel was convinced that the bleaching of it would be the more difficult, as the action of the vapour of burning sulphur upon it reduces it so considerably, or, as we may say, almost to nothing; whilst both silk and wool, as is well known, are bleached by this means in a most complete manner. The finer the sponges, the more easily they are bleached. The following method has succeeded extremely well for this purpose:—

The sponges must first be sufficiently steeped in cold water; for if they were to be put into either boiling or even warm water, it would produce a most destructive effect upon them; as they would shrink, their pores would be closed, they would become hard, and it would be impossible to bleach them afterwards.

But if the sponges are steeped in cold water, which should be changed every three or four hours, and if at each time it is changed they were submitted to so strong a pressure as to be entirely freed from the water, at the expiration of five or six days they would become sufficiently washed, and be prepared for the bleaching.

If, as it frequently happens, the sponges retain, in their interior, small calcareous stones, which it might be supposed could not be extracted without tearing them or beating them to pieces, yet it is easily effected by allowing them to steep for 24 hours in muriatic acid, diluted with 20 parts of water: this produces a slight effervescence, from the extrication of the carbonic acid gas; and the calcareous concretions disappear, being dissolved in the most complete manner.

Then, after having been very carefully washed, the sponges are thrown into a solution of sulphurous acid, of the specific gravity of 1,024; or which marks about 4° on the areometer of Beaumé. The following is the best manner of preparing this acid:—Put into a glass retort, one pound of pulverized charcoal, and one pound of concentrated sulphuric acid; and, by means of a bent tube, convey the gas, which is extricated, into a vessel, where it may be combined with eight pints of water, according to the Bavarian measure.†

The immersion of the sponges in this acid is to be continued for eight days; but during this time they are to be repeatedly submitted to the action of a press; and, lastly, they are allowed to remain 24 hours in running water.

When the sponges have thus been washed in a sufficient quantity of running water, they may be sprinkled with rose or orange-flower-water, for the purpose of communicating to them an agreeable odour; after which, they must be allowed to dry gradually in the open air.

* From *Archiv. fur die gesammte Naturlehre*, Vol. I. No. II. p. 248.

† It might, probably, answer the purpose, to combine the gas first with two pints of water, and afterwards, to dilute the acid with six pints more, when it is to be used for bleaching the sponges.

NATURAL HISTORY.

Notes on the Rattlesnake. By John James Audubon, F.R.S.E., M.W.S., &c.*

The power of fascination gratuitously ascribed to most snakes by theoretical naturalists, has so long riveted the attention of all persons inclined to think on the subject, but without the means of judging for themselves, that the following fruits of many years' observation, in countries where snakes abound, will not, I hope, though adverse to the supposed power of fascinating, be looked upon as destitute of interest.

Rattlesnakes in particular appear to have acquired their chief fame from this supposed charm. I shall, therefore, draw your attention more directly to the habits of that species, and begin by enumerating the many real and extraordinary faculties bestowed upon it. These consist in swiftness; in powers of extension and diminution of almost all their parts; in quickness of sight; in being amphibious; in possessing that wonderful and extraordinary benefit of torpidity during winter, and long-continued abstinence at other periods, without, however, in the mean time losing the venomous faculty, the principal means of their defence. I shall proceed to elucidate, by well-authenticated examples, all those different faculties.

Rattlesnakes hunt and secure for their prey, with ease, gray squirrels that abound in our woods; therefore they must be possessed of swiftness to obtain them. Having enjoyed the pleasure of beholding such a chase in full view in the year 1821, I shall detail its circumstances. Whilst lying on the ground to watch the habits of a bird which was new to me, previous to shooting it, I heard a smart rustling not far from me, and turning my head that way, saw, at the same moment, a gray squirrel full grown, issuing from the thicket, and bouncing off in a straight direction, in leaps of several feet at a time; and not more than twenty feet behind, a rattlesnake of ordinary size pursuing, drawn apparently out to its full length, and sliding over the ground so rapidly, that, as they both moved away from me, I was at no loss to observe the snake gain upon the squirrel. The squirrel made for a tree, and ascended to its topmost branches as nimbly as squirrels are known to do. The snake performed the same task considerably more slowly, yet so fast, that the squirrel never raised its tail, nor barked, but eyed the enemy attentively as he mounted and approached. When within a few yards, the squirrel leaped to another branch, and the snake followed by stretching out full two-thirds of its body, whilst the remainder held it securely from falling. Passing thus from branch to branch with a rapidity that astonished me, the squirrel went in and out of several holes, but remained in none, knowing well that, wherever its head could enter, the body of his antagonist would follow; and, at last, much exhausted and terrified, took a desperate leap, and came to the earth with legs and tail

* Read before the Wernerian Natural History Society, 24th February, 1827.

spread to their utmost to ease the fall. That instant the snake dropt also, and was within a few yards of the squirrel before it had begun making off. The chase on land again took place, and ere the squirrel could reach another tree, the snake had seized it by the back, near the occiput, and soon rolled itself about it in such a way that, although I heard the cries of the victim, I scarcely saw any portion of its body. So full of its ultimate object was the snake, that it paid no attention to me, and I approached it to see in what manner it would dispose of its prey. A few minutes elapsed, when I saw the reptile loosening gradually and opening its folded coils, until the squirrel was left entirely disengaged, having been killed by suffocation. The snake then raised a few inches of its body from the ground, and passed its head over the dead animal in various ways to assure itself that life had departed; it then took the end of the squirrel's tail, swallowed it gradually, bringing first one, and then the other of the hind legs parallel with it, and sucked with difficulty, and for some time, at them and the rump of the animal, until its jaws became so expanded, that after this, it swallowed the whole remaining parts with apparent ease.

This mass of food was removed several inches from the head in the stomach of the snake, and gave it the appearance of a roleau of money brought from both ends of a purse towards its centre; for, immediately after the operation of swallowing was completed, the jaws and neck resumed their former appearance. The snake then attempted to move off, but this was next to impossible; when having cut a twig, I went up to it, and tapped it on the head, which it raised, as well as its tail, and began for the first time to rattle. I was satisfied that for some lapse of time it could not remove far, and that the woods being here rather thin, it would soon become the victim of a vulture. I then killed it, and cut it open to see how the squirrel lay within. I had remarked, that after the process of swallowing was completed, singular movements of the whole body had taken place,—a kind of going to and fro for a while, not unlike the convulsive motion of a sick animal, as a dog, for instance, about to vomit. I concluded that some internal and necessary operation was going on. This was proved when I found the squirrel lying perfectly smooth, even as to its hair, from its nose to the tip of its tail. I noted all this on the spot. This over, I sought my game again, and felt a great satisfaction; but having met my friend, Mr. James Perry, on whose lands in the State of Louisiana I was then hunting, and having related what had just happened, he laughingly said, "Why, my dear sir, I could have told you this long ago, it being nothing new to me." These facts, I trust, are quite sufficient to exemplify the faculties of swiftness, and the powers of extension and diminution in the rattlesnake. In regard to quickness of sight,—I have several times discovered a snake to be near me from a sudden and brisk rustling amongst the dead leaves or grass, as a vulture or forked-tail falcon was passing over the place in search of food, and by close investigation discovered that some snake had made away to hide under a log, root, or stone, from its winged enemy; for, after being satisfied that

the noise thus heard was produced by snakes labouring to escape through fear, I have remained snug and silent, and have seen them issue from their covert when the vulture had gone by. But, further, I have frequently seen them move their heads sideways, looking up to the trees, and discovered that they were then in search of birds' nests; and so watchful of the parent's motions, that, as if afraid to suffer by the encounter with a bird of size and power, they made choice of the time when both parents were absent, to ascend and rob them either of the young or the eggs, if not fully laid and ready for incubation. Should the snake, in such attempts, be perceived by the owners of the nest, their cries of alarm and attack are heard through the woods, and so many other birds assemble and pour in from all sides, that it becomes nearly impossible for the snakes to make good their retreat. I shall merely add, that those battles and defeats are corroborated by one of our most eminent naturalists in America.

That almost all snakes can swim, and do swim well, too, and can remain under water a considerable time, is a fact sufficiently ascertained; but that, in this element, they have the power of pursuing fish, and of catching either them or frogs, is a fact which, though equally true, is not so well known. I shall, therefore, present to you some proofs of this from my own observation. Whilst fishing on the banks of the Schuylkill river, not very far from Philadelphia, about twenty years ago, I saw a snake issue out of the water close to me, and slide up a large stone to receive the benefit of the sun. I perceived it to be swelled about its middle, and shot it to ascertain its contents, when I discovered in the stomach a cat-fish scarcely dead; so fresh, indeed, that I made it my prize, and felt no ways alarmed at eating it when dressed. Since that time I have had opportunities to see snakes chasing bull-frogs, follow them after they had leaped into the water, and return with them in their mouths. Several other species, indeed, make the water their almost constant place of abode, one of which the Congo (*C. nigra,*) an extremely venomous snake, is found in great numbers in all the lakes and watery swamps of the Southern states.

Periodical torpidity in snakes, as in almost all animals subject to it, has been wisely ordered, on account of the very slow growth granted to most of them. Snakes, as well as alligators, increase in size very slowly, and are, consequently, long-lived; but how transient, if needed, this most wonderful power granted them to live, to die (as it were,) and to live again, is, I shall try to describe by the following curious fact:—M. Augustine Bourgeat, whose name will be ever dear to me, my younger son, and myself, where hunting one winter-day for ducks, and having halted awhile near a lake, we struck up a fire. Being desirous to eat what we were pleased to call our dinner, we began picking and cleaning some of our game. The youngest of our party ran about for wood, and, anxious that a good supply should be at hand, attempted to roll a log, at a short distance, towards the spot pitched on. In doing this, my son discovered so large a rattlesnake closely coiled up, in a torpid state, that he called us to come and look at it. It was stiff as a stone, and, at my request, my son

put it into my game-bag, then upon my back, for further observation. Shortly afterwards, whilst our game was roasting upon the wooden-forks, stuck in front of our cheerful fire, I felt something moving behind me, which I thought for a moment was occasioned by the struggles of a dying duck; but presently recollecting the dangerous animal, I begged my friends to see if it was not the snake; and being assured that it was, the time employed in unstrapping and throwing off the bag with the reptile, was, I assure you, of very short duration. The snake was then quite alive, issued from the bag, and began rattling, with its head elevated, and thus ready, while the body was closely coiled, to defend itself from all attacks. The distance at which it then was from our fire, and the consequent cold, would, I thought, soon conquer it: and in this I was not mistaken; for, before our ducks were roasted, the snake had stopped its alarum, and was bent on finding a place of refuge, again to become torpid. Having finished our meal, my son, who had watched all its movements with the eagerness of youth, brought it again, with a smile, saying, "Papa, look at Hercules and the serpent!" We took it home, and it became torpid, or revived, at our pleasure, as often as we removed or brought it near the fire; until having put it in a jar of spirits, it travelled to the Lyceum of New York.—That all their faculties become dormant, and remain virtually dead during torpidity, I have ascertained, by finding snakes with great quantities of food in the stomach, frozen and undigested, although it had been there for several weeks; when, if the snake was removed to a warm situation, the operation of digestion was daily perceptible, and the whole food in a short time consumed.

Rattlesnakes have the power of laying down their fangs along their jaw-bones when at rest, and of raising them again at will; as sharks also do, and some other fishes. It is only when inflicting a *defensive* wound that their fangs are used. At this time, the snake, either coiled, or in any other position, has the power of darting about two-thirds of its body towards its object, and, with its mouth open to its utmost stretch, all its fangs being erect, it strikes so violent a blow whilst it bites, that I have been assured, by some Osage chiefs, that on such occasions, they felt, when struck, as if about being thrown off their centre of gravity. The fangs make their way into flesh, or indeed, tough leather, with perfect ease, and instantaneously. The wound is generally mortal, if proper remedies be not at once resorted to. Among the *native Americans*, cutting out the wounded part, and searing, or, as it is termed in the country, *scaring* it with fire, is considered the most effectual,—but even this requires great promptitude to afford a chance of safety. The quantity of venom infused is more or less, as the animal may have been more or less irritated. If made to bite themselves, their own flesh affords no antidote, for they die in excruciating torments. The venom of a rattlesnake, while the animal is striking against any object, will be sometimes ejected to a considerable distance. I have seen one confined in a wire-cage, when much enraged, strike against the bars so furiously, that the poison was sent several feet towards me.

I have been told by native Americans, that arrows dipt in rattlesnake venom, would carry death for ages after.

Some European writers of great eminence have asserted, that rattlesnakes are destroyed by hogs in such quantities that the introduction of the latter into any country would soon clear it of the former. In the United States, where hogs are very numerous, I never witnessed any one attempt to kill a rattlesnake, and have, on the contrary, remarked that hogs were shy of these reptiles; but if this were not the case, the ease with which rattlesnakes can either make their escape, or defend themselves, is such, that the hog would, in preference, I think, avoid the danger, and without risk, feed on congenial food, which is ever under his nose, and in great abundance throughout all our woods, unless, indeed, the hog were endowed with the power of fascination, a thing not yet communicated by those writers. But why, I would ask those closet naturalists, do not the rattlesnakes fascinate their opponents the hogs as well as birds?

The flesh of rattlesnakes was considered a dainty by the Spaniards, whilst in possession of Louisiana. Mr. James Perry, a principal alcaide in the parish of St. Francis at that period, has assured me, that the officers garrisoned on the heights of Fort Adam, were in the habit of giving premiums to the soldiers and Indians who brought them the largest and fattest. The head being cut off, the snake was suspended, so as to become entirely drained of its blood, and the flesh cooked as that of chickens, which it much resembles. Their skins were tanned, and beautiful shoes are still made with them, which retain all the variegated marks exhibited on the scales of the animal when alive.

Perhaps one of the most wonderful faculties possessed by this and many other species of snakes, is that of being able to live for years without any food whatever; and quite as remarkable, that, during the lapse of this astonishing fast, their appearance and condition scarcely exhibit their being in any want. Their movements, the power of rattling, and that of inflicting mortal wounds, are perfectly kept up. One which I confined in a cage for three years had frequently rats, young rabbits, and birds of various kinds put in, sometimes alive, and at other times dead, without their ever being touched; not even a movement would be made by the snake to approach them; while, on the contrary, the live quadrupeds and birds showed great symptoms of fear, and threw themselves violently in all directions about the cage, to effect their escape from an enemy well known to them. The operation of throwing off its skin annually was, however, abandoned, after the first spring of confinement; and, as the individividual was small, and I did not consider it as arrived at its middle age, I measured its length with accuracy, and discovered, that, during the whole time of its imprisonment, it did not grow in the least. To what extent this power of abstinence is ever used, when the animal is at liberty, I am unable to tell, but I have thought, that the animal possessing it so eminently, went a great way towards proving that it had not that of fascination; as it would be very unnatural for an animal so gifted to lie and suffer, while the single glance of a magnetic

eye could bring down a bird at once from the top of any tree into its mouth.

I now and then turned the snake out of its cage, when, with great quickness, it would go about the room, looking in all directions, with a view to effect its escape. As I was armed with a long stick, it never made towards me, but if I put myself in its way, it would stop, prepare for action, and rattle until I removed, and afforded it a free passage.

Rattlesnakes are easily disabled, and afterwards killed. A single smart blow, even of a slender twig, will disjoint any part of the vertebræ, after which they lie at your mercy.

The mode of copulation used by these reptiles is so extraordinary, that I must not omit a description of it, as it is my chief purpose to record any facts regarding them that may be novel, or but little known. Early in spring, as soon as the snakes have changed the skin that contained their last year's growth, they issue brightly coloured, glistening with cleanliness, and with eyes full of life and fire. The males and females range about, in open portions of the forest, to enjoy the heat of the sun, and, as they meet, they roll and entwine their bodies together, until twenty, thirty, or more, may be seen twisted into one mass, their heads being all turned out, and in every direction, with their mouths open, hissing and rattling furiously, while, in the mean time, the secret function is performed. In this situation they remain for several days on the same spot, and the danger of approaching such a group would be very great; for, at sight of any enemy to disturb them, they all suddenly disengage, and give chase. The fact of their rattling, which tends to alarm intruders, and to warn them of their danger, is too well known to call for any observations regarding it.

To conclude: suffer me to call to your recollection a well known fact, that birds of all kinds are full of courage; that even the smaller tribes will attack, and chase before them, the larger kinds, and that those again will even defend themselves from man, and often with success. Have we not all seen the little robin chase a cat? An eagle will keep off a man from her nest, and a cock will attack even a lion. This being the case, why should they suffer their senses to sink in sleep before a reptile, when, with a few mere flaps of their wings, they can so easily escape? After this reflection, can we for a moment imagine, that the Creator has exposed the feathered race to such dangers as the power of fascination would imply? We may rest assured, that, when snakes destroy birds, or any other animals, it is by the quickness of their motion, and the acuteness of their sight, seconded by cunning and strength, but never by fascination.

Mode of Condensing and Preserving Vegetable Substances for Ships' Provision, &c.

THE quantity of liquid matter which enters into the constitution of vegetables is very great; when they are deprived of it their bulk is very trifling. That preparation of animal food, called *pemmican*, in which six pounds of meat are condensed into the space of one, is mainly effected by abstracting all the fluid from it. Vegetables may be treated in the same way: let them undergo the process of boiling over a fierce wood fire, so as to preserve their colour when *completely* cooked; grind them into a complete pulp by some such means as are used to crush apples for cider, &c.; then let them be subjected to the action of the press, (being first put into hair bags, or treated as grapes are in wine countries,) till all the fluid matter is separated from them; the remainder of their substance becomes wonderfully condensed, and as hard as the *marc* from the wine press. Then let it be rammed hard into carefully glazed air-tight jars, (or tin cases, if preferred,) and subjected to the Appertian process for preserving animal and vegetable matters (well known, by-the-by, to our grandmothers, who preserved gooseberries in this way from time immemorial.) If jars are used, they may be sufficiently secured by having two pieces of bladder tied successively over them; when the air within is absorbed by heating the enclosed substance, their surface becomes concave by the pressure of the atmosphere, and as long as it remains in this state the matter within is safe. If it should be thought requisite to preserve the flavour of the vegetables entire, an extract should be made from the expressed liquid, and added to the *marc*. But spinage, cabbage, and many others, have abundance of flavour in them in their dry state without this addition. The preparation of the vegetable matter for use, is accomplished by adding a sufficient quantity of milk, water, gravy, lime-juice, &c., to the *marc*, and warming it up. Let the government, and the dealers in ships' provision, look to this; a sufficient quantity of this *vegetable pemmican* would be the greatest luxury to a ship's crew, and render the scurvy utterly obsolete. It is worthy of remark, that the most irritable stomach is not offended by vegetables treated in this way.

[*Qu. Jour. of Science.*

Experiments with Bottles sunk into the Sea. Made during a voyage from New South Wales. By Mr. JAMES DUNLOP.

Experiment I.—April 9, 1827, in lat. 24° South, and long. 43° 10′ West, the ship becalmed off Rio de Janeiro, the boat was lowered down, and rowed a short distance from the ship; the deepsea lead was let down eighty fathoms, with the following experiments attached to it, consisting of a common porter-bottle, well corked and pitched over, and secured by a covering of new canvass, which was also covered by a thick coat of pitch; also a tin canister, with

holes pierced in its bottom, and open at the top, in which were placed four small thermometer tubes filled with mercury, all of which would burst with a less temperature than 100° of Fahrenheit; also five small glass globes hermetically sealed by the blow-pipe, two of which were vacuum (or as nearly so as I could make them,) other two were suffered to cool, previous to their being sealed, and the fifth contained a small globule of mercury, to enable me to detect any damp, as an experiment of the porosity of glass; three glass phials, well corked, and firmly secured by leather coverings, tied round the necks, and further secured by a coating of sealing-wax, were also put into the canister. After letting them remain ten minutes at the depth of eighty fathoms, the line was hauled in, and the experiments examined. The porter-bottle was nearly filled with water, and the cork floating inside; the covering of canvass and pitch was pressed concave into the mouth of the bottle, but the pitch was not cracked or broken. The four thermometers, and also the small glass globes, came up unbroken. I examined the one which contained the small globule of mercury, and it gave not the slightest indications of damp having penetrated through the glass. The three phials came up full of water: of one of them the cork was forced in, and swimming in the water; in another, the cork was forced about half an inch into the neck; and the cork of the third was not apparently affected, or displaced, in the least degree, although the phial was full of water, and also several pieces of the sealing-wax lying in the bottom, which could by no means have got into the bottle, but by the cork being driven in. The wax on the top of each was broken or cracked in regular concentric rings from the centre, and the coverings of leather burst, as well that in which the cork was not displaced as in the others. Indeed, the hole in the leather which covers the phial with the remaining cork, is larger than in the others, in which the cork is driven in; which, in all probability, may be accounted for, by considering this cork to have been tighter fitted into the phial, and requiring a greater force to displace it: there would be a greater rush of the water into the phial, and the cork forced again into its neck. I think it more than probable this has been the case, otherwise the bits of sealing-wax could not have got into the phial had the cork retained its station; neither could we account for the bursting of the leather and wax which fastened down the cork.

In preparing for the second set of experiments, I attempted to guard against the possibility of the corks being forced in, or the pressure of the circumincumbent column at all affecting the corks. I prepared two (four or five ounce) phials: the corks were dipped in strong gum dissolved in ether, and thrust into the mouth of the phials; they were allowed to remain in this state for several days to dry. The corks were then cut close to the mouth, and covered with several thick coats of varnish, and afterwards covered with leather, firmly tied round the neck, which was also covered or soaked in varnish, and suffered to dry; and for further security, the heads and necks of the phials were immersed in brass caps, filled with melted sealing-wax, to prevent the possibility of pressure upon the corks. I also

prepared a small phial by simply thrusting in the cork as tight as possible, and cutting it close to the mouth, and afterwards covering the mouth and neck of the phial one-fourth of an inch thick with black sealing-wax.

On the 15th of May, in lat. 5° North, and long. 26° West (the ship becalmed,) these three phials were wrapped in old canvass, and, together with the thermometers and glass globes used in the former experiments, were all put into a tin case, open at the top, and fastened to the line just above the lead: a porter-bottle fitted up as formerly, was also attached to the line. The boat was rowed a short distance from the ship, and the lead let down one hundred and eighty fathoms, and allowed to remain about eight or ten minutes at that depth before we commenced hauling in the line. On examining the experiments, the two (five ounce) phials, which were secured by the brass caps, were broken or crushed to powder, with the exception of the thick part of the bottom, and the neck which was protected by the brass caps. The other small phial, which was much stronger in the glass, and only secured by the cork, covered one-fourth of an inch thick with sealing-wax, was not broken or injured in the least, though a very minute quantity of water had found its way into the phial, probably through the wax and cork; and, I have no doubt, had the phial been allowed to remain a sufficient time at that depth, that it would have filled with water, probably without breaking the wax, or forcing in the cork. Neither the thermometers nor the small glass globes were broken, nor could I perceive the slightest appearance of damp in the small globe which contained the globule of mercury, to indicate porosity in the glass. The porter bottle came up full of water as formerly.

The porter bottle in this, and also in the other experiment, was prepared by Captain Mood, commander of the Portland, who assisted, and gave every facility for making experiments, when the weather, and other circumstances, would permit.

My object with the thermometer, was to ascertain whether an increase of temperature took place at a considerable depth in the ocean; and not being provided with a self-registering thermometer, the only resource I had was to make several, about three inches long, and by immersing the bulbs in water heated to a known temperature, the superfluous mercury was forced out; and the moment it began to subside, the tube was sealed by the blow-pipe. The one which indicated the lowest temperature, required but 73° or 74° of Fahrenheit to raise the mercury to the top of the stem; but experiment proved the unsatisfactory results I might have expected, as it required a temperature of above 80° to burst the slender bulb. The experiments of Captain Sabine and others prove the temperature of the ocean to decrease at considerable depths below the surface.

I think it can hardly fail to convince any one who makes the experiment of sinking bottles in the sea, and assists personally in the hauling in of the line, that the great force necessary to haul it in must be occasioned by the pressure of the superincumbent column of water. And I have no doubt that the same experiment may be

performed, and powerful effects produced, on a bottle well corked and secured, being placed in a cast-iron cylinder filled with water, and the *force applied by a hydrostatic press*, on the top of a solid piston (which must be well fitted into a smaller cylinder fixed on the top of the larger one,) the piston pressing upon the surface of the water in the small cylinder. And many interesting experiments might be performed in the lecture room, by substituting a very strong cylinder of glass, having its ends ground parallel, and fitted into brass caps accurately ground to fit the outside of the ends of the cylinder, and the bottom of the caps lined with leather, to prevent the pressure of the screws, necessary to connect the caps, and keep them water-tight, from chipping the glass. To one of the brass caps must be fixed a well-bored cylinder, for the solid piston to slide in, &c. Sea-water might be used in the cylinder, with a thermometer to show what capacity water may have to retain its caloric when under a high pressure. Such experiments would be interesting to compare with experiments which have been made on the temperature of the sea at great depths; and also the specific gravity of the water in the cylinder ascertained before and after the experiment, which would probably throw light on the subject of increased specific gravity of water drawn from great depths, and also whether the effects of pressure on water are permanent, and owing to the imperfect elasticity of water. [*Jameson's Edinburgh Journal.*

Diet in Britain and France.

WHAT is called the influence of climate on the human species, may be resolved, we suspect, chiefly into the effects of diet, which necessarily varies with the geographical position of each country. Thus, in cold climates, the stomach prefers animal food, and calls for, or, at least, comes more readily to relish, the stimulus of ardent spirits; while, in regions nearer the sun, men subsist chiefly on bread, and fruits, and prefer the mild produce of the grape to strong, brewed, and distilled, liquors. The French are more sober than the Germans, because the warmer temperature of their country enables them to substitute wine for the ale, and rye-brandy, of their neighbours. The Spaniards again are more sober than the French, for reasons not so obvious, but which still resolve themselves into the effects of climate. In the hot soil of the Peninsula, the orange, citron, and a multitude of other juicy fruits, come to perfection, which do not succeed in France; and the delicious cooling drinks which these afford, indispose the stomach for spirituous stimuli, and render even wine less necessary. Madame de Stael attributes the stern tempers and gloomy mythology of the northern nations, to the perpetual fogs and rigorous winters of their climate. To some extent she may be right; but we question if the peculiarities she speaks of may not be considered as partly the effect of that depression of

animal spirits which fills up so large a portion of the life of those who are constantly addicted to the use of violent stimuli.

The characteristic of the southern nations of Europe is not so much positive gaiety, as an equable flow of the animal spirits. They are less the slaves of care than the people of the north, and more disposed to snatch the frivolous and fleeting pleasures which the hour presents. As they do not seek the exaltation which intemperance gives, they are strangers to the mental depression which follows it. The Frenchman is habitually ready to enter into a hundred small schemes of amusement, which the Englishman affects to despise, while he secretly envies the elasticity of spirit that gives their zest. The latter, (we include the Scotsman too,) proud and anxious, never lays aside his phlegm till deep drinking has made him boisterous and quarrelsome. There are four articles which have produced an extraordinary change in the mode of living of the European nations in recent times—tea, coffee, sugar, and tobacco. The introduction of these into common use is one of the most singular achievements of modern commerce. Three centuries ago, who would have believed that the produce of China and the West Indies would now form the daily food of our menial servants and labourers! The following tables, compiled from authentic documents, throw light on the habits of the two most distinguished nations of Europe.

Quantities of sugar, tea, &c. consumed in Britain and France:—

		Britain.	France.
Sugar (1824)	lbs.	448,000,000	128,000,000
Tea (average)	do.	22,750,000	195,000
Coffee (1824)	do.	8,100,000	20,100,000
Tobacco (do.)	do.	16,900,000	7,200,000
Wine (do.)	Old Gal.	6,210,000	700,000,000
Spirits (1826) Foreign 3,960,000, Home 24,060,000	do.	28,020,000	5,700,000
Beer (1826)	Ale Galls.	420,000,000	155,000,000

But, in order to come to correct conclusions, we must always take into account the numerical amount of the population of the two countries. In the following table we have therefore calculated what the consumption is for one million of inhabitants in each.

		For one million Of Englishmen.	Of Frenchmen.
Sugar	lbs.	22,400,000	4,270,000
Tea	do.	1,137,000	6,500
Coffee	do.	405,000	670,000
Tobacco	do.	845,000	273,000
Wine	Old Galls.	310,000	23,300,000
Spirits	do.	1,400,000	190,000
Beer	Ale Galls.	21,000,000	5,170,000

[*Mechanics' Register.*

On Lightning Rods and Compasses. *By Dr.* Fischer.

Dr. Fischer states, that when iron is magnetised it loses much of its conducting power for ordinary electricity; and concludes from his observations, that iron, which is known to become magnetic by even feeble electric explosions, is a very improper metal for the construction of lightning rods. He relates an instance in which a rod of this metal, placed as a lightning-conductor upon a powder-magazine, had entirely failed on several occasions in preventing the explosion of lightning close by its side. Upon examining this rod, it was found to have attractive and repulsive magnetic properties.

M. Fischer consequently recommends copper as the metal to be used, and advises that the end be gilt or made to terminate in a gold point, rather than with platina, because the former is so much superior in conducting power.

The conclusions of M. Fischer with regard to the decrease of conducting power in iron, when magnetised, are in singular contrast to the assertions of Mr. Abraham, who states that the conducting property is wonderfully increased by making iron magnetic, and recommends that all lightning-rods be of magnetised iron. We doubt whether any effect is produced either way.

M. Fischer endeavours to prevent the disturbance of the magnetic needle from neighbouring masses of iron, by placing it in a bowl of that metal of equal thickness throughout. He states, that the needle points north and south, and is not affected by the approximation of iron. The means are the same, generally, as those practised some years ago in this country by Mr. Jennings, who surrounded his needles with a strong ring of iron. The effect is also stated to be the same.

Mr. Abraham used two cast-steel rods, properly hardened and tempered, each three feet in length, and half an inch in diameter; one end of each bar was hammered to a fine point, and one bar was rendered magnetic; then a brass ball was placed two inches off from the prime conductor of a machine, and the points of the unmagnetised and magnetised bars brought alternately towards it; the magnetic bar (it is said) prevented the passage of sparks between the conductor and ball when it was twelve inches off, whilst the other required to be brought to within nine inches.

Signs of Increase, Maturity, and Decay in Trees. *By* M. Baudrillart.

The qualities of wood depend much on the state of the tree when cut down. It appears, from the experiment of M. Harting upon wood applied as fuel, that trees which have attained maturity without passing into decay, are the best for the production of heat. Thus the value of an elm of one hundred years is to that of one of thirty

years, as twelve is to nine; that of an ash of one hundred years to one of thirty years, as fifteen to eleven. When the trees begin to decay, their value rapidly diminishes; thus, if an oak of two hundred years yields wood worth fifteen francs per cord, a tree of the same kind passing to decay yields wood only worth twelve francs. When the wood is used for other purposes, the advantages conferred by a mature, but healthy state, are still more considerable.

The common elm, growing in a forest and in good earth, acquires its full increase in about one hundred and fifty years, but it will live many ages, even five or six hundred years. Large forest elms are cut down with advantage when of an age between one hundred and one hundred and thirty years, and then furnish a large quantity of building wood. The duration of the life of an elm depends much upon the soil; in a dry soil it becomes aged, as it were, in forty, fifty, or sixty years. Elms which have been lopped, live for a shorter period than the others. Those which grow by the road side, or in thin plantations, may be cut when seventy or eighty years of age. In general, the increase of hard woods, as the oak and the elm, is small at first; it successively augments until the twentieth or twenty-fifth year, is then uniform until the age of sixty to eighty years, after which it sensibly diminishes.

For these and others reasons, it is important that trees should be cut down when they are at their mature state, and not simply when they undergo no further increase. When the period has arrived after which the increase of the tree would be less and less from year to year, then the tree should be felled, for no advantage accrues from its remaining longer in the ground. The indications of the mature state of a tree are by no means so evident as those of decay, but still certain signs of these states, as well as of the vigorous condition of the tree, may always be observed.

I. *Signs announcing the vigour of a Tree.*

The branches, especially towards the top, are vigorous; the annual shoots strong and long; the leaves green, vigorous, and thick, principally at the summit, and falling late in autumn; the bark is clear, fine, united, and nearly of the same colour from the foot to the large branches. If at the bottom of the veins, or divisions, of the thick bark, there appear smaller divisions which follow from below, upwards, in the direction of the fibres, and live bark be observed at the bottom of these divisions, it is an indication that the tree is very vigorous and rapidly increasing in size. If some of the lower branches, stifled by the others, are yellow, languishing, and even dead, this is an accidental effect, and is no proof of the languor of the tree. Finally, it is a sign of vigour when branches are seen at the summit of the tree, rising above and being much longer than the others; but it is to be observed that all trees with round heads do not throw out branches with equal force.

II. *Signs which indicate that the Tree is mature.*

Generally the head of the tree is rounded; the shoots diminish in length each year, and the furthest shoots add to the length of the

branches only by the length of the bud; the leaves are put forth early in spring and become yellow in autumn before those of vigorous trees, and at this time the lower leaves are greener than the upper. The branches incline towards the horizon, and form angles sometimes of sixty or seventy degrees. These apparent signs, and the thinness of the layer deposited by the sap, indicate that the tree makes but small additions to itself, and now it should be cut down. The nature of the earth should be examined, as well also as the kind of tree, to form a judgment whether the tree should be left to increase still further, or whether it will be more proper to fell it. An exact age cannot be assigned for each species; but it has been observed, that an elm situated in an insulated plantation may be felled with advantage when between seventy and eighty years of age.

III. *Signs of decay in a Tree.*

When a tree becomes crowned, *i. e.* when the upper branches die, it infalliby indicates, especially for isolated trees, that the central wood is undergoing alteration, and the tree passing to decay. When the bark separates from the wood, or when it is divided by separations which pass across it, the tree is in a considerable state of degradation. When the bark is loaded with moss, lichen, or fungi, or is marked with black or red spots, these signs of alteration in the bark justify suspicions of alterations in the wood within. When sap is seen to flow from clefts in the bark, it is a sign that the trees will soon die. As to wounds or gutterings, these defects may arise from local causes, and are not necessarily the result of old age.

Method of reviving Plants, Shoots, Sprigs, Slips, and other Vegetables.

This is called a proved method of reviving plants, &c. when their leaves and buds are faded, and their bark and roots hard and nearly dry, by M. de Droste, of Hülshof. The directions are to dissolve camphor to saturation in alcohol, adding the former until it remains solid at the bottom of the latter; a sufficient quantity of rain or river water is then to have the alcoholic solution added to it, in the proportion of four drops to one ounce of water. As the camphor comes in contact with the water, it will form a thin solid film, which is to be well beaten up with the water: for a short time the camphor will float in the water in small flocculi, but will ultimately combine with the fluid, and disappear.

Plants which have been removed from the earth, and have suffered by a journey or otherwise, should be plunged into this camphorated water, so that they may be entirely covered: in about two, or at most three hours, the contracted leaves will expand again; the young, faded, and dependant shoots will erect themselves, and the dried bark will become smooth and full. That being effected, the plant

is to be placed in good earth, copiously watered with rain or river water, and protected from the too powerful action of the sun, until the roots have taken good hold of the ground.

When large plants, as trees, are to be revived, their roots are to be plunged into the camphorated water for three hours; the trunk, and even the head, of the tree being frequently wetted with the same water, so as to retain them in a properly moistened state. But it is always best, if possible, to immerse the whole of the plant. Shoots, sprigs, slips, and roots, are to be treated in a similar manner.

If plants thus treated are not restored in four hours, their death may be considered as certain, for they cannot be recalled to life by any artificial means. They should, consequently, never be left more than four hours in the camphorated bath; because the exciting action of the camphor, when it is continued for a longer period, may injure the plants instead of doing good to them. It is not necessary to say that the final prosperity of the plants, thus re-animated by the camphorated water, must depend upon the particular properties of the former, the state of their roots, and the pains that are taken with them. The camphor produces no other effect than to restore life to plants nearly dead: after that, all proceeds according to the ordinary laws, and their ultimate state must be left to art and nature.

Account of the Diamond Workings and Diamonds of Sumbhulpore. By Peter Breton, Esq., *Surgeon, Superintendent of the School of Native Doctors at Calcutta.**

The districts of Chota, Magpore, and Sirgoojah are not marked for their mineral productions; but Sumbhulpore† has been, from time immemorial, distinguished for its production of the finest oriental diamonds in the known world. They are occasionally found in the bed of the Mahanuddee, and at the mouths of other rivers which terminate in it. The following is an extract from the observations of a gentleman, whose source of information on this interesting subject was the best that could be obtained in Sumbhulpore:—

The Mahanuddee is navigable for six months in the year, though not without obstructions and difficulties, for boats of three to four hundred maund's burthen, from the sea to Sooreenarain, which cannot be less than three hundred and eighty miles; and for smaller vessels as far as Sumbhulpore, for ten months. Diamonds of various sizes, and of the first quality, are occasionally found at the mouths of the rivers Maund, Keloo, Eeb, and others, which all have their sources in the mountainous parts of Koorba, Sirgoojah, Raegurh, Jushpoor, and Gangpoor, and fall into the Mahanuddee on its left bank. They are also picked up, after the termination of the rains,

* This curious paper is abridged from the *Transactions of the Medical and Physical Society of Calcutta.*

† The valley of Sumbhulpore is four hundred and ten feet above the sea.

amongst the mud and sand deposited on the beds of islands on the left bank, (where the stream, being resisted, makes a sharp turn,) by persons of a peculiar class, whose occupation it is to search for them. I cannot learn that diamonds have ever been found on the right bank of the Mahanuddee, or on the left bank above its confluence with the Maund at Chunderpore, or below Sonepoor. It would appear, therefore, that they were washed down from the sides of the streams which flow from north to south through the mountainous and almost inaccessible track which occupies, in Arrowsmith's Map, the 83d and 84th degrees of east longitude, and 21st and 22d degrees of north latitude. This inference is further supported by the fact of their being not unfrequently met with in the beds of Nullahs in Raegurh, Jushpore, and Gangpoor, though I have no reason to think that any attempt has been ever made to discover and open their mines or beds; and this may be chiefly accounted for by the state of society and government in these wild regions. Any attempt on the part of a private individual to appropriate to himself, or conceal a diamond, would, if discovered, have been assuredly punished with death; and the rajahs have mutually preferred this scanty and uncertain acquisition of precious stones in the manner I have described, to the publicity and consequent interference of the Mahomedan or Marhatta sovereigns, by whom they were in turn ruled, which would necessarily have resulted from the establishment and working of mines. Another obstacle has doubtless been the extreme insalubrity of the climate of the tract under consideration—an insalubrity which the observation of many years has convinced me always attached to mountainous and woody districts, in which gold and diamonds are indigenous. None but natives of the wilds, whose appearance sufficiently marks the ravages of disease, can enter them with impunity, excepting in January and the three succeeding months, and this would form the chief objection to the employment of skilful European mineralogists, whose researches, if they could be adequately persevered in, would, I am sanguinely of opinion, be attended with very interesting and important results.

There were two tribes or castes of diamond searchers in Sumbhulpore, of whose origin, or of the period of their settlement in this part of the world, I can learn nothing. They have the appearance, however, of aborigines. The names of the tribes are Ihara and Tora. Sixteen villages of the poorer description have been always enjoyed by them in rent-free Jageers; of these, four are in the hands of the Toras, ten possessed by the Iharas, and two have been given to their tutelar deity Bukeser Pat, an appellation of Mahadeo. They are under the direction of three chiefs, or Sirdars, two of the Ihara tribe, called Pater and Buhera, and one of the Tora, styled Seeree Ghakur. They search for gold as well as diamonds, and are allowed to dispose of all the former article they pick up. Their habits are extremely dissipated; and when they find a diamond they spend the money it procures for them in a continued scene of debauchery. In the Pergunnahs of Raegurh, Sonepoor, Jushpoor, and Gangpoor, are also to be found persons of this kind. In the two last-mentioned a species

of gold mine is to be found, the aperture only just large enough for a man to descend, but of considerable extent below. An account of the mine in Gangpoor, from which it is stated to me that a species of pure gold of considerable size has been obtained, remains to be submitted.

The diamond-searchers, with their women and children, amounting to between four and five hundred persons, are annually employed from the month of November till the commencement of the rainy season in searching the bed of the Mahanuddee for diamonds. They examine such parts of the river as are obstructed by rocks from Chunderpoor to Sonepoor, a distance of about one hundred and twenty miles, and all the hollows in the bed of the Mahanuddee in which alluvial matter is deposited. The process pursued by the searchers is extremely simple, and three implements only are used by them. The first is a kind of pick-axe with one pick, called Ankooa; the second, a plank of about five feet in length, and two feet in width, made a little concave towards the centre, and a rim of three inches in height on each side, called Doer; and third, a board of similar form, but only half the size of the former, called Kootla. With the pick-axe the earth is dug out of the hollows, and collected in heaps near the stream: pieces of this earth are then placed by the women on the large board, which is so inclined as to allow the earth, when mixed with water, gradually to run off; the pebbles and coarse gravel are then picked and thrown away, and the remaining mass is afterwards removed from the large to the small board, and spread over the latter, to admit of every particle being minutely examined, and gems and grains of gold, if any be present, being collected. The earth in which the diamond is usually found consists of a mixture of stiff reddish clay, pebbles, and a small proportion of sand and a little oxide of iron. This earth the searchers take particular pains to find, and they examine every particle of it with the greatest attention.

Although employed exclusively in this occupation from time immemorial, the Iharas have not the remotest idea of what constitutes the matrix of the diamond. Mr. Mawe, in his *Account of the Diamonds of Brazil*, states, that "the only places where diamonds have certainly been found in modern times are the central and southern parts of India Proper, the peninsula of Malacca, the Island of Borneo, and the mountainous district called Serro Do Frio, and other places in Brazil. Neither the rock in which it occurs, nor the other minerals with which it is accompanied in Malacca and in Borneo, are at all known. In India it is found in detached crystals, in a kind of indurated, ochrey gravel; but whether or not this is its native repository is uncertain."

The diamonds of Brazil, like those of India, are found in a loose gravel-like substance, immediately incumbent on the solid rock, and covered by vegetable mould and recent alluvial matter. This gravel consists principally of rounded quartz, pebbles of various sizes mixed with sand and oxide of iron, and enclosing rounded topazes, blue, yellow, and white, and grains of gold. In some parts of the diamond territory of Serro do Frio, which I visited, the gravel is cement-

ed, by means of the oxide of iron, into a considerably hard conglomerate, forming rocks and low hills. On the sides of these are water-courses, produced by the torrents during the rainy season, the beds of which are very unequal and excavated. In these hollows diamonds are not unfrequently discovered. The usual and regular method of searching for diamonds is to collect the disintegrated conglomerate in which they are found at the bottoms of rivers and of ravines, and by a laborious process of washing, as long as the water comes off discoloured, to separate the mud from the distinct grains. The residue, thus cleaned, is subjected to an accurate examination for the diamonds which it may contain. These are distinguished partly by their crystalline form, but principally by their peculiar lustre, slightly verging on semi-metallic, but which cannot be adequately described by words.

If the above-mentioned conglomerate be not the real matrix of the diamond, its true geological situation is unknown, for it has never as yet been discovered in any other rock.

Now, although the Sumbhulpore diamond is more frequently found in the red earth above described, yet it is now and then met with in other kinds of compositions. The proof of this red conglomerate being its matrix is by no means established. In the late Dr. Voysey's *Description of the Diamond Mines in Southern India*, it is stated that the only rock in which the diamond is found is the sandstone breccia.

In the reign of the former rajahs and ranees in Sumbhulpore, the right to all diamonds found in the bed of the Mahanuddee was established, and on a diamond of magnitude being found by the Iharas, the finder was rewarded by a grant of a small village in Jageer, and by presents in money and clothes. When detected in secreting a diamond, they were punished with death, or by being severely beaten and deprived of their Jageers, and of the privilege of again searching for diamonds.

The facility with which a diamond, when found by the Iharas, can be secreted, (for, instead of vigilance being exercised over them, they are left to use their own discretion in searching for this gem,) and the extreme difficulty in detecting the fraud, render it more than probable that many very valuable diamonds are at this moment in the possession of the finders, which they are afraid to disclose. For, in 1818, on the power of the British government being established in Sumbhulpore, a diamond which had been secreted, by the searchers, from the former rulers of Sumbhulpore, was actually brought and delivered to the late political agent, and by him sent to government as a part of the property of Sumbhulpore, which, by right of conquest, became the property of the state. It weighed eighty-four grains, and was valued at five thousand rupees.

At Sumbhulpore the quality of the diamond is named after the four tribes of the Hindoos. A diamond of the first quality is called Brahmin; the second is named Chetree; the third Bysh; and the fourth Soudra; and, from experience, the native jewellers judge pretty accurately of their respective qualities. The weights they employ for weighing the diamond are the ruttee and masha; the former is a frac-

tion less than two grains troy weight, and seven ruttees make a masha. Rough diamonds are estimated according to their quality. The first quality is valued at, per masha, 500 sicca rupees; second at 400 sicca rupees; third at 300; and fourth at from 175 to 200 sicca rupees per masha. This mode of valuing a rough diamond is somewhat different from the rule laid down by Jeffries for ascertaining the value of this gem in its native state. According to Jeffries, the carat weight of a rough diamond is squared, and then multiplied by 2, and the product is the value of the gem in pounds sterling. For example, a diamond of 20 carat weight, $20 \times 20 = 400 \times 2 =$ £800 sterling. If the product of the square of the carat weight of a cut diamond be multiplied by 4 instead of 2, its total will be the value of a cut diamond in pounds sterling. This rule applies only to diamonds of small weight, for the value of a diamond of magnitude increases, without any established rule, rapidly with its size.

The large diamond found in 1809 was of the third (Byshes) quality. It was picked up in the month of October, at a place called Herakode, in the bed of the Mahanuddee; and its delivery to Ranee Ruttun Coher was unluckily delayed on account of her being engaged in performing the funeral ceremonies of her husband's mother; and before they were finished, the Marhatta troops arrived and expelled her from the country. A traitorous servant of her's betrayed the secret of the valuable stone to Chunderjee Bhoonsla, the commanding officer, who persuaded the diamond-finders to surrender it to him by promises of the grant of a fine village and a thousand rupees. On the following morning, when they appeared to claim performance, they were reproached for bringing a stone instead of a diamond, and driven from his presence.

French Building Regulations.

The dreadful accident that has occured at the Brunswick Theatre, and the insecurity of the public, from the ignorance or negligence of individuals, calls imperiously for some legislative regulations similar to those adopted by the French government. In France, details of every part of the plan and construction of the public buildings must be previously submitted to a government architect, who examines the whole carefully, and suggests the alterations and modifications which he judges necessary for the public safety: and it is only on his written approval of the plan that the construction is permitted to be executed. Nor does his charge end here; he superintends the works as they proceed, and prevents the slightest deviation from the plan as sanctioned by him. Had such a regulation existed in England, the calamity at the Brunswick Theatre would not have happened.

The paternal care of the French government, in whatever concerns the public safety and health, is admirable. In England, we

hear continually of houses in a state of dilapidation falling, and entombing numerous persons in the ruins. In France there are regular inspectors, who go systematically through Paris, to ascertain the state of the houses; and whenever the slightest appearance of danger is obvious, the tenants are ordered to quit, and the place is pulled down. Private interests are never consulted, when the personal safety of the public is concerned. This *surveillance* is extended to the construction of all forges, furnaces, steam-engines, the manufactories of chemical products emitting offensive odours, &c. If a high-pressure engine be permitted in a town, one of the conditions is, that it shall be surrounded by a wall four feet thick; and the chimney must rise to a certain height above the adjoining buildings. The engine is not even permitted to be wrought, unless the boiler has been previously proved capable of supporting a power of steam four times greater than that at which it is intended to work. Besides these precautions, every boiler must be provided with a metallic plate, fusible at a small degree above the working power, that in case the safety valve should not act, or any other dangerous circumstance arise whereby the steam would become of a greater force than intended, the plate may melt, and the steam escape in abundance by the orifice. A few months since, a dyer, near Paris, who had a high-pressure engine, was interdicted working it, on account of the insecurity of the boiler. The proprietor ordered another to be made, and invited the officers of government to witness the proof of it at the maker's: it was intended to work at two atmospheres, and perfectly resisted the force of eight atmospheres; and was, consequently, approved. The proprietor, however, thinking to be too cunning, did not send for it, but had his old boiler cut shorter and used again. The government engineers, not suspecting the trick, did not examine the boiler when putting up. The engine had not been at work two hours, when the new end of the boiler was blown off at the rivets; the steam rushed out, and destroyed two houses in the rear; and the boiler itself was driven in a contrary direction, through the engine-house, to the distance of sixty yards; though weighing above two tons: it destroyed the engine, and killed the engineer and the proprietor, who happened to be in the engine-house. This accident arising from the wilful misconduct of the proprietor, his family was ordered to grant a pension to the widow of the engineer.

[*Literary Gazette.*

History of the Telegraph.

The telegraph, though it has been generally known and used by the moderns only for a few years, is by no means a modern invention. There is reason to believe, that amongst the Greeks there was some sort of telegraph in use. The burning of Troy was certainly known in Greece very soon after it happened, and before any person had returned from thence. Now that was altogether so

tedious a piece of business, that conjecture never could have supplied the place of information. A Greek play begins with a scene, in which a watchman descends from the top of a tower in Greece, and gives the information that Troy was taken. "I have been looking out these ten years," says he, "to see when that would happen, and this night it is done." Of the antiquity of a mode of conveying intelligence quickly, to a great distance, this is certainly a proof.

The Chinese, when they send couriers on the great canal, or when any great man travels there, make signals by fire from one day's journey to another, to have every thing prepared; and most of the barbarous nations used formerly to give the alarm of war by fires lighted on the hills or rising grounds.

Polybius calls the different instruments used by the ancients for communicating information πυρσιαι, *pyrsiæ*, because the signals were always made by means of fire. At first they communicated information of events merely by torches; but this method was of little use, because it was necessary beforehand to fix the meaning of every particular signal. Now, as events are exceedingly various, it was impossible to express the greater number of them by any premeditated contrivance. It was easy, for instance, to express by signals that a fleet had arrived at such a place, because this had been foreseen, and signals accordingly had been agreed upon to denote it; but an unexpected revolt, a murder, and such accidents as happen but too often, and require an immediate remedy, could not be communicated by such signals; because to foresee them was impossible.

A new method was invented by Cleoxenus, (others say by Democritus,) and very much improved by Polybius, as he himself informs us. He describes this method as follows:—Take the letters of the (Greek) alphabet, and divide them into five parts, each of which will consist of five letters, except the last division, which will have only four. Let these be fixed on a board in five columns. The man who is to give the signals is then to begin by holding up two torches, which he is to keep aloft till the other party has also shown two. This is only to show that both sides are ready. These first torches are then withdrawn. Both parties are provided with boards, on which the letters are disposed as formerly described. The person, then, who gives the signal is to hold up torches on the left, to point out to the other party from what column he shall take the letters as they are pointed out to him. If it is to be from the first column, he holds up one torch; if from the second, two; and so on for the others. He is then to hold up torches on the right, to denote the particular letter of the column that is to be taken. All this must have been agreed on beforehand. The man who gives the signals must have an instrument, (διοπτραν,) consisting of two tubes, and so placed as that, by looking through one of them, he can see only the right side, and through the other only the left, of him who is to answer. The board must be set up near this instrument; and the station on the right and left must be surrounded with a wall, (παραπεφραχθαι,) ten feet broad, and about the height of a man, that the torches raised above it may give a clear and strong light, and that when taken down they may

be completely concealed. Let us now suppose that this information is to be communicated—*A number of the auxiliaries, about a hundred, have gone over to the enemy.* In the first place, words must be chosen that will convey the information in the fewest letters possible; as, *A hundred Cretans have deserted,* Κρητες εκατον αφ' ημων αυτομολησαν. Having written down this sentence, it is conveyed in this manner:—the first letter is a K, which is in the second column; two torches are therefore to be raised on the left hand, to inform the person who receives the signals to look into that particular column. Then five torches are to be held up on the right, to mark the letter *k*, which is the left in the column. Then four torches are to be held up on the left to point out the ϱ (*r*), which is in the fourth column, and two on the right, to show that it is the second letter of that column. The other letters are pointed out in the same manner. Such was the *pyrsia*, or telegraph, recommended by Polybius.—See Polyb. lib. x. ext. 7. cap. 2.

But neither this, nor any other method mentioned by the ancients, seems ever to have been brought into general use; nor does it appear that the moderns had thought of such a machine as a telegraph till the year 1663, when the Marquis of Worcester, in his *Century of Inventions*, affirmed that he had discovered "a method by which, at a window, as far as the eye can discover black from white, a man may hold discourse with his correspondent, without noise made or notice taken; being according to occasion given, or means afforded; *ex re nata*, and no need of provision beforehand; though much better if foreseen, and course taken by mutual consent of parties." This could be done only by means of a telegraph, which in the next sentence is declared to have been rendered so perfect, that by means of it the correspondence could be carried on "by night as well as by day, though as dark as pitch is black."

Dr. Hooke, whose genius as a mechanical inventor was, perhaps, never surpassed, delivered a "Discourse to the Royal Society, May 1684, showing a way how to communicate one's mind at great distances." It was not, however, till the French Revolution, that the telegraph was applied to useful purposes. Whether M. Chappe, who is said to have invented the telegraph first used by the French about the end of 1793, knew any thing of Hooke's or of Amonton's invention, it is impossible to say; but his telegraph was constructed on principles nearly similar. The manner of using this telegraph was as follows:—At the first station, which was on the roof of the palace of the Louvre, at Paris, M. Chappe, the inventor, received in writing, from the Committee of Public Welfare, the words to be sent to Lisle, near which the French army at that time was. An upright post was erected on the Louvre, at the top of which were two transverse arms, moveable in all directions by a single piece of mechanism, and with inconceivable rapidity. He invented a number of positions for these arms, which stood as signs for the letters of the alphabet; and these, for the greater celerity and simplicity, he reduced in number as much as possible. The grammarian will easily conceive that sixteen signs may amply supply all the letters

of the alphabet, since some letters may be omitted, not only without detriment, but with advantage. These signs, as they were arbitrary, could be changed every week; so that the sign of B for one day might be the sign of M the next; and it was only necessary that the persons at the extremities should know the key. The intermediate operators were only instructed generally in these sixteen signals, which were so distinct, so marked, so different the one from the other, that they were easily remembered. The construction of the machine was such, that each signal was uniformly given in precisely the same manner at all times; it did not depend on the operator's manual skill; and the position of the arm could never, for any one signal, be a degree higher or a degree lower, its movement being regulated mechanically.

M. Chappe, having received at the Louvre the sentence to be conveyed, gave a known signal to the second station, which was Mont Martre, to prepare. At each station there was a watch-tower, where telescopes were fixed, and the person on watch gave the signal of preparation which he had received, and this communicated successively through all the line, which brought them all into a state of readiness. The person at Mont Martre then received, letter by letter, the sentence from the Louvre, which he repeated with his own machine: and this was again repeated from the next height, with inconceivable rapidity, to the final station at Lisle.

The first description of the telegraph was brought from Paris to Frankfort on the Maine by a former member of the parliament of Bourdeaux, who had seen that which was erected on the mountain of Belville.

Two working models of this instrument were executed at Frankfort, and sent by Mr. W. Playfair to the Duke of York; and hence the plan and alphabet of the machine came to England.—Various experiments were in consequence tried upon telegraphs in this country; and one was soon after set up by government, in a chain of stations from the Admiralty-Office to the sea-coast.

Telegraphs have now been brought to so great a degree of perfection, that they convey information speedily and distinctly, and are so much simplified, that they can be constructed and maintained at little expense. The advantages, too, which result from their use are almost inconceivable. Not to speak of the speed with which information is communicated and orders given in time of war, by means of them, the whole kingdom could be prepared in an instant to oppose an invading enemy. A telegraph might also be used by commercial men, to convey a commission, cheaper and speedier than an express can travel. An establishment of telegraphs might be made like that of the post; and instead of being an expense, it would produce a revenue. Something of this kind was, about twenty years ago, set up to facilitate the intercourse between Norwich and Yarmouth; and a new and extensive plan of the same kind was lately in agitation.—*Gregory's Mechanics.*

FOR THE FRANKLIN JOURNAL.

On the combination of a Practical with a Liberal course of Education. By W. R. Johnson, *Principal of the High School of the Franklin Institute.*

In the present state of public feeling with regard to education, no apology will be required for an attempt to aid its advancement. A constantly increasing interest in the subject, forbids us to suppose that the science and practice of instruction, can remain stationary, while other arts and sciences are advancing. Pursue what other trade or profession we may, the art of developing mind cannot be neglected. We owe it to conscience,—to patriotism,—to humanity;—to posterity, that the generation now rising to enjoy the blessings, and sustain the responsibilities, of civil and religious liberty, should not be left to grope in the darkness of ignorance, and thus to disgrace the institutions which their fathers have founded. Indeed, a conviction, that all the substantial interests of society are dependent on the diffusion of learning, is rapidly pervading every class of American citizens.

Aware that no advantages of soil, of climate, of commercial facilities, of wealth acquired, or wealth transmitted, can compensate for a deficiency of moral and intellectual culture, they are, with different degrees of zeal, endeavouring to establish and improve their systems of universal education. The *industrious* are sure of profit, and the *independent* of pleasure, from the same source. The private citizen finds his highest happiness in refined and polished society. The statesman feels it to be his greatest glory to make and administer laws among a people of whom every individual can appreciate his merits. In such a community, wealth confers no privilege but that of being foremost in acts of beneficence, and poverty will neither be offered nor received as an apology for acts of knavery and duplicity.

Would a town, city, or state, possess weight in the scale of public estimation? it must be derived, mainly, from the spirit which presides over public instruction. Wealth cannot purchase the desired influence. Arrogant pretensions will never be long accepted in place of *real* intellectual worth.

A few great men, may, it is true, do much towards conferring respectability on their state, or district; but unless they move amidst men of similar character, they serve, like the columns at Persepolis, only to make the surrounding desolation more frightful. It does not particularly delight the eye of a republican to behold a few pyramids and palaces, amidst a million of hovels; and how can it be more consonant with his feelings, to contemplate ignorance, vice, and wretchedness, yielding a blind homage to that greatness, which, perhaps, becomes apparent, only by a comparison with what is absolutely mean and diminutive.

The republic claims a right to all the effective talent which can

possibly be elicited, from among every class of her sons, and which can aid to sustain the dignity and consistency of her character.

Nor are we without *external* motives for sustaining the cause of universal education. Distant nations look to America, to set the example of abolishing those odious *monopolies* in learning, which have for ages closed the career of generous competition against ninety-nine hundredths of mankind. The feudal times saw learning, as they saw wealth and titles, entrenched behind barriers which it was profanation for any but the privileged orders to approach.

To impose more effectually on a half enlightened age, learning assumed her costly trappings, her pomp and circumstance, her sounding titles, and a certain supercilious behaviour.

The scholastic wisdom of those times consisted, in a great measure, of a kind of knowledge, for which common men could have no manner of use, and which was often but a mere matter of pride to its actual possessor. It is justly expected of *America*, that she will banish the childish follies of learning, and retain only its wisdom; that keeping pace with the improvements of the age, she will apply the excellencies of every method, the useful parts of every system, in the construction of that which is intended to diffuse the highest degrees of usefulness and happiness.

Leaving the politicians to wrangle about the "*American system*" of internal policy, we may venture to lay down some principles for the formation of a *republican system of education*, such as reason demands, and experience has already justified. On this subject we may reasonably anticipate that the nation will form but one party. As all are satisfied that republican government, is, in itself, a blessing; and not only abstractly good, but *practically* better than any of the forms of European despotism, whether absolute or limited; so all should unite to establish and foster a system of education, consistent with the character of a self-governed people.

Such a system must be founded on the principle of equal rights, and equal obligations;—equal rights in those who are to be educated, and equal obligations on those who are to furnish the pecuniary means. To realize this principle in its full extent, *public* institutions, adequate to the wants of every class in society, must be established in every part of our country.

In defect of such institutions, those seminaries which are established by societies, or individuals, ought to approach as near as possible to the character of public schools, both in the liberality of their terms, the wide extension of their advantages, and their subjection to the influence of public opinion. Differences between parents, in respect to fortune, trade, profession, religious sect, or political party, ought to make no difference in the kind or degree of early instruction offered to their children.—Economy of *time* and *money* is a primary requisite in every system of education intended for general adoption. Every device which can aid the attainment of this desirable end, must therefore be introduced.—In the business of teaching, the greatest division of labour which is consistent with strict economy, ought to prevail.—To promote economy, to excite emulation, to give each student an opportunity to compare himself with many

others, and by a strict classification according to advancement, to prevent the retardation of one, through the dulness of another, a school must be more numerous than could be conveniently instructed by a single individual, and must be provided with a greater or less number of teachers, according to the greater or less number of branches to be embraced, and to the higher or lower rank which it is to hold in the scale of institutions.—The greatest practical subdivision of classes is desirable.—Its methods of instructing and governing ought to embrace whatever is most efficient and useful in all the systems of education which have been promulgated.—Self improvement by active exertion is ever to be preferred to the passive reception of knowledge from others. Hence the strongest incitements to *voluntary* study should be offered to the students.

The foregoing are a few of the leading maxims which were followed in the formation of an institution connected with the Franklin Institute, and of which it is proposed to give hereafter a rather more detailed account, than has yet appeared.

The following remarks extracted from an address of the Committee of instruction, published at the time of opening the establishment, further illustrate its design.

"In forming this school, it was the aim of the board, to give to the sons of tradesmen, and other citizens in moderate circumstances, the same advantages of education, which have heretofore been almost exclusively enjoyed by the children of the rich. In this country, where permanent distinctions of rank are inconsistent with the spirit of our republican institutions, it is impossible to tell, from the situation of the parent, what may be the destiny of the child. The board have therefore selected a course of studies, such as experience has proved to be the most useful for the advancement of the pupil in future life, and such as is universally selected by the enlightened parent, whose wealth enables him to make a choice for his son. Against the adoption of such a system, the only rational objection that can be urged, is the expense of time and money which it generally involves. But the modern improvements in education, and particularly the plan of monitorial or mutual instruction which is introduced into the High School, have nearly removed these difficulties."

It is proposed to give, in a few essays, an exposition, as brief as the subject will admit, of the course of study, system of instruction, practical results of the different methods of teaching, and of such other points as have constituted the subjects of frequent inquiry with those persons who have applied for information respecting the institution above mentioned.

Observations on the Phenomenon observed by M. CLEMENT, *in the emission of Steam, and on an analogous effect in the attempt to separate two flat disks by a current of air.*

MUCH interest was excited by the phenomenon first observed by M. Clement, of Paris, an account of which will be found in vol. 4, p. 97 of this Journal; and also some remarks thereon, by Mr. Perkins, at p. 252 of the same volume. A similar phenomenon has since engaged the attention of the curious, the apparatus for exhibiting which is so extremely simple that every one can try the experiment for himself. Take two disks of card about the size of a dollar, perforate one of them in the centre, so that a tube may fit it; a common quill answers the purpose perfectly well; if these disks be placed upon each other, wind may be blown through the tube without separating the disks, or if one of them be placed on a table, it may be raised up by causing the perforated disk to approach it, and blowing through the tube.

Of this phenomenon Professor Hare has published a rationale; and we have received two others from correspondents, the whole of which we now publish, presenting them in the order in which they have been written. EDITOR.

Rationale, of the difficulty, in certain cases, of separating plane surfaces by a blast. By R. HARE, M. D., *Professor of Chemistry in the University of Pennsylvania.*

THE phenomenon above alluded to, is usually illustrated by means of two disks, into the centre of one of which a tube is fastened, so that on blowing through the tube the current is arrested by the moveable disk. Under these circumstances the moveable disk is not removed, as would be naturally expected.

Supposing the diameter of the disks to be to that of the orifice as 8 to 1, the area of the former to the latter must be as 64 to 1. Hence if the disks were to be separated (their surfaces remaining parallel) with a velocity as great as that of the blast, a column of air must meanwhile be interposed, 64 times greater than that which would escape from the tube during the interim. Consequently, if all the air necessary to preserve the equilibrium be supplied from the tube, the disks must be separated with a velocity as much less than that of the blast, as the column required between them is greater than that yielded by the tube, and yet the air cannot be supplied from any other source, unless a deficit of pressure be created between the disks unfavourable to their separation.

It follows then, that under the circumstances in question, the disks cannot be made to move asunder with a velocity greater than 1-64th of that of the blast. Of course, all the momentum of the aerial particles which constitute the current through the tube will be expended on the moveable disk, and the thin ring of air which exists

around the orifice between the disks; and since the moveable disk can only move with 1-64th of the velocity of the blast, the ring of air in the interstice must experience nearly all the momentum of the jet, and must be driven outwards, the blast following it in various currents, radiating from the common centre of the tube and disks. The effect of such currents in producing an afflux of the adjoining portions of any fluid in which they may be excited, is well known, having been successfully illustrated by Venturi. See Nicholson's Journal, quarto, vol. 2nd, p. 172.

Accordingly the afflux of the air towards the disks counteracts the small velocity which the blast would communicate, and thus prevents their separation, and may even cause them to approach each other, if previously situated a small distance apart.

This rationale commences with the assumption that the disks will remain nearly parallel. That there cannot be much deviation from parallelism must be evident, since any obliquity will make the opening greater on one side than on the other; and the jet proceeding with most force towards the widest opening, will increase the afflux of air upon the outer surface of the moveable disk in the part where the current is strongest, and thus correct the obliquity. [*Chronicle.*

An inquiry into the cause of the adhesion of disks, when an attempt is made to separate them by a current of air. By James P. Espy, *Professor of Languages.*

TO THE EDITOR OF THE FRANKLIN JOURNAL.

Philadelphia, June 20th, 1828.

Dear Sir,—The subjoined explanation of the phenomenon to which it relates was given by me to a gentleman of this city, in reply to a communication from him, and may probably be deemed worthy a place in your Journal.

Yours, &c.

James P. Espy.

If you take two disks of common playing cards, about two inches in diameter, or even less, and insert the end of a small tube into a hole made in the centre of one of them, and lay the other on the top, and cause a current of air to pass through the tube with moderate velocity, the upper card will not be removed, but will be pressed towards the other card with considerable force; a force sufficient to support its weight, when the experiment is performed with the cards reversed, and the current of air made to pass downwards.

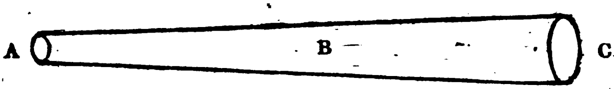
The only explanation of this remarkable phenomenon, that I have seen, which has any plausibility, is that of Professor Hare, which you had the kindness to send me. The direct force of the current at the centre of the disks is correctly estimated, and is, indeed, very small, where a free passage is given to the air laterally; but the counteracting force assigned by the Professor is, if it exists at all, hardly appreciable, and is therefore not the true cause of the phenomenon.

The following I consider as the *experimentum crucis* to disprove Professor Hare's theory. I placed a disk of card on a table, and applied the other disk with the tube attached, near the one on the table, and blew downward: the current of air could not be produced so as to strike against the lower side of the disk on the table, yet the disk rose, in opposition to the current through the tube.

The true theory I believe to be, that during the passage of a current of air through the tube, and between the disks, there is less air between the cards in a given space than when the air is at rest, and, of course, the pressure on the inside is diminished, while that on the outside remains the same.

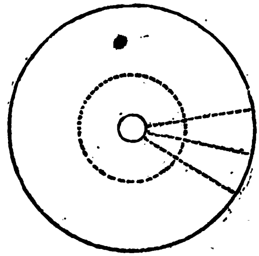
Let us see if this assertion can be established from principles known and acknowledged by all philosophers.

Let A, B, C, be a tube, widening from A to C. Suppose air to be forced in at A, under a double condensation, sufficient to carry it from A to B in a second.



It is manifest, from the nature of inertia alone, it will incline to move with a uniform velocity through the whole length of the tube; but in consequence of the elasticity of the air, the velocity will be increased, until it arrives at a part of the tube sufficiently increased in area to permit the density in the inside to be equal to that of the atmosphere; after *that* the velocity, from inertia, inclines to continue the same; but, as the tube becomes wider, it cannot do this without becoming rarer than atmospheric air, which actually takes place in its passage through the remainder of the tube.

Now, what has been said of the tube A B C, may be applied to the phenomenon in question.



Suppose the annexed figure represents the interior of the two disks, the whole of that space may be conceived as consisting of innumerable tubes widening from the centre to the circumference. After the air is turned into these tubes, which is done, as Professor Hare shows, with a very small force, the reasoning used above concerning a single tube will apply to the whole area of the cards; the air will increase in velocity by the *vis a tergo*, as long as it is denser than the atmosphere; but as soon as it arrives at a part of the disks where the area is sufficiently enlarged, (suppose at the inner circle,) to permit the air to expand to an equal density with the atmosphere, the *vis a tergo* ceases, and it is urged forward with the last acquired velocity, retarded, it is true, by the atmosphere, but not so much so as to prevent it from expanding, and thus becoming rarer than atmospheric air.

How much rarer than the atmosphere the air will be between the two circles, will depend on the degree of condensation in the tube, and if the air is only moderately condensed it will be nearly as much rarer between the circles as it is denser within the inner circle. With regard to the distance from the centre where the air becomes of equal density with the atmosphere, it will depend on the shape of the hollow; but as the experiment is generally performed, it will not be much more than double the diameter of the tube.

Now, as the air, which is denser than the atmosphere, occupies but a small portion of the area of the disks around the centre, and a much larger portion of it is occupied by air which is lighter than the atmosphere, the disks will be pressed together with the difference of these forces, minus the direct impulse of the air in front of the tube, whilst it is turning at right angles to its course in the tube.

Perhaps it may be objected to this hypothesis, that the resistance of the atmosphere to the egress of the air from between the disks, will prevent the air from becoming rarer than the atmospheric air at rest.

To this I answer, that I have lately ascertained by some experiments in hydraulics, (which I shall publish before long,) that as much water runs out in a given time through a hole in the side of a vessel containing water under a given head, when the egress is made below the surface of water, as when made in the open air. If then water, which is nearly 800 times denser than the atmosphere, makes no more resistance to the efflux of water than the air does, may we not reasonably infer, that, in very short tubes at least, the atmosphere makes no sensible resistance to the egress of a current of air? Indeed, I intend to show from theory, that some tubes will discharge more water in the atmosphere than in vacuo.

On the difficulty of separating flat disks by a current of air, or of steam, when their surfaces are in contact, or nearly so. By ASA SPENCER, *Mechanician.*

TO THE EDITOR OF THE FRANKLIN JOURNAL.

SIR,—Agreeably to my promise, I offer for insertion in your Journal, my theory respecting the adhesion of disks, which I shall be pleased to see published, should it meet your views.

Yours, &c.

ASA SPENCER.

In the Journal of the Franklin Institute of last year, was published a communication by M. CLEMENT of the following purport.

A flat valve being placed over an orifice in a steam chest, and covering a considerable space around the orifice, when the steam was let on, the valve, instead of rising, as was expected, kept its place, and required a considerable additional force to lift it.

To this phenomenon I offered the following explanation to some of my scientific friends, who thought it satisfactory.

The extent of the valve, we will suppose to equal four square inches,

its surface flat, and placed on the steam chest, where the surface is also flat. We will also suppose a space between the surfaces, sufficient to admit the atmosphere, it is evident that the top and bottom of the valve will be then equally pressed by it, and in that state the valve may be lifted with a force only sufficient to overcome its gravity.

Suppose an opening to be now made in the chest, under the centre of the valve, equal to one square inch, or one-fourth the size of the valve, the steam being then let into the chest with a power of thirty pounds to the inch, this rushes against, and communicates the same power to the one inch of the valve immediately over the aperture, which being only about half the force of the atmosphere on the whole 4 inches on the top of the valve, it cannot rise with any thing like the velocity with which the steam would move; its current, therefore, must necessarily be checked. Now currents of fluids on meeting an immoveable obstacle are not reflected back, like solids, but take a direction parallel to the surface against which they strike: currents of fluids also, whether elastic or nonelastic, exert no force, but in the direction in which they move; the latter is fully proved by forcing air, or water, through a cylindrical tube, if holes be made in the sides of the tube none of the fluid will escape.

It follows, then, that the steam on striking against the valve, as above mentioned, and thus arrested in its course, which was perpendicular to the valve, takes one parallel to it, and rushes out in all directions, in radii from the centre; of course, the atmosphere between the disks is driven out, leaving nothing between but steam, and that exerting no force on the valve except on the one inch in the centre, its course over the remaining surface is parallel to it, and its force is exerted only in that direction.

The state of the valve would then be as follows; pressed upwards by steam of 30 pounds to the inch, acting on the one inch only at the bottom, and pressed downward by the weight of the atmosphere of 15 pounds to the inch, acting on the whole four inches at top; making the downward, double that of the upward pressure.

The above will appear pretty evident, by the following experiment: take two thin flat plates of metal, tin plate for example, about three inches diameter, in the centre of one insert a tube several inches long, and about $\frac{1}{8}$ of an inch in diameter perpendicular to its planes; let both plates be pierced full of holes except near their centres; let these plates be placed with their surfaces parallel to each other, and about $\frac{1}{16}$ of an inch apart, and attach the tube to a cock under a considerable head of water; when the water is let on it passes by the tube through the first plate, and on being checked by the second plate, passes out between them in a thin and even sheet, while none escapes through the holes. This happens when the force of water is at least equal to two atmospheres. This experiment has been repeatedly tried, and varied in different ways, with the same uniform result.

The preceding, and the problem of the cards, I consider as cases precisely similar; the same effect produced by the same cause. I therefore, in a concise form, gave a similar explanation, which was published in the United States Gazette some weeks since.

I have since seen a solution of the latter problem by Professor Hare, who attributes the effect to a different cause. He supposes that the blast coming out in various currents from the common centre of the tube and disks, causes an afflux of the surrounding air towards them, and as Mr. Perkins expresses it, (who explained the problem of the valve in the same way that Dr. Hare has that of the cards,) "impinges" on the whole outer surface of the disk, and counteracts the power of the blast, which acts only on a small part of the inner surface. To satisfy myself of the fallacy of this, I used means which I thought effectual to cut off all afflux of air towards the disk, which could have a tendency to keep them together, when I found the effect as prompt as before; which made me conclude, they were not kept together by any *flow* of air, but by the constant and steady *pressure* of the atmosphere which rested on them at the time the blast commenced, and continues unabated, while that on the inner surfaces is lessened by being met and opposed by the force of the blast, running out between the two inner surfaces of the cards.

I attempted to illustrate this by a tube six inches in length, and about the diameter of a large quill, at the end of which I fixed two strips of paper $\frac{3}{4}$ of an inch wide, and extending about three inches from the end of the tube; on blowing with force through the tube, the strips of paper were brought together by a very prompt and rapid movement. I observed the same effect, when this tube, with the strips of paper, was placed within another tube of $1\frac{1}{2}$ inch diameter and 10 or 12 inches long.

Account of the accident from lightning, which happened to the packet ship the New York. By T. Trail Stewart, M. D., *of Liverpool. Read before the Royal Society, February 21st,* 1828.

We have already published an account of the accident narrated in the following paper, in our 4th vol. p. 197; but as this contains some particulars not mentioned in the former, we have determined to present it also. Some of the English Journals state the fact, that the elderly gentleman who "forgot his debility," walked home from the vessel upon her arrival in Liverpool, and has ever since retained the use of his limbs. Is it not more probable that this was the effect of electricity, than of terror from the crash? Editor.

"The ship which met with the accident of which the effects are the subject of this communication, was the American packet the New York, of 526 tons, commanded by captain Bennet. She sailed from New York for Liverpool, on the 16th of April, 1827; and on the morning of the 19th was struck by lightning, which shattered the main royal mast, and gliding down the iron chain main-top-sail tie, burst the iron bands on the main mast head. It was thence conducted

by the iron main-top-sail sheets, to the iron work of the pumps. It then entered between decks, demolishing the bulkheads that form the store-room, in its way to a small leaden cistern: whence it was conducted, by a leaden pipe, through the starboard side of the ship, where it started three five-inch planks, ten feet in length, at the lower part of the bends. Many other parts of the ship, not in the direct line of its passage, were also shattered, apparently from the effects of a lateral explosion, several doors and partitions were thrown down, a large mirror in the cabin was shivered into small fragments, and a piano-forte was thrown down, its top torn off and broken in pieces. The loudness of the explosion was appalling, and spread universal consternation. A sulphurous smoke, which had issued with a bluish flame from the hatches, filled the cabins; and at first inspired alarm, lest the cargo in the hole, consisting chiefly of cotton and turpentine, had taken fire; but on clearing the main hatch, it was soon ascertained that no danger from fire existed. The ship however had sprung a leak, which made four inches of water every hour, but which on washing the pumps was found to be under command, and would not prevent her proceeding on her voyage to England.

"When the first terror created by the accident had somewhat subsided, it was found that none of the passengers or crew had sustained any injury. The chief mate was sleeping in the birth opposite to the main-hatch, near the spot where the lightning entered the store-room, the lock of which was forcibly driven into his cabin: but he was not himself affected by the shock; and a quantity of gunpowder which was kept under his bed, was fortunately not ignited by the lightning. An ewer and a basin placed on a stand over a child's bed, were thrown down by the explosion, but the child had escaped unhurt. A remarkable effect was however produced on an elderly gentleman, who for the last five years had not been able to walk half-a-mile at a time: terrified by the crash, he forgot his debility, and springing from his bed, rushed on deck with singular quickness and agility. He has retained, ever since the event, the power over the muscles of his limbs, derived from this sudden emotion.

"The threatening aspect of the heavens, the appearance of numerous water-spouts on the surface of the sea, and other electrical indications, gave rise to apprehensions of further danger, and induced the captain to put up the conductor with which he was provided, but which had not been previously applied. It was made of iron links eighteen inches long, connected by iron rings an inch in diameter; and was furnished at the top with an iron rod four feet long, and half an inch in diameter, tapering to a fine point. This rod was fixed so as to rise three feet above the main royal mast head; and the chain was made to descend along the back-stay, and below was kept at a distance of ten feet from the starboard bulwarks by a light wooden outrigger, or spar. Its whole length was 145 feet, of which about nine feet of its lower part descended into the sea. The wisdom of adopting this precaution was soon apparent, for in the course of the same morning, the ship was struck by a second explosion, which is

stated by the unanimous testimony of all on board, to have far exceeded the first in violence. It melted a great part of the conductor, producing a vivid combustion of many of the links, which burnt like so many tapers; and descending into the sea, darted off to a considerable distance along the surface of the waves. The resistance to its passage was so great as to cause the ship to recoil with a sudden and violent shock, so as to throw down several of the crew. The melted iron of the conductor fell in large drops on the deck, which, already strewed with hail-stones that had previously fallen, intermixed with rain, was set fire to in many places by the ignited metal. No damage, however, was done to the masts or rigging, nor the least injury to any of the crew, with the exception of a carpenter, who being at work with an iron auger in his hand, received a smart shock through the wrists, which occasioned a vivid tumour, which was still visible six weeks after the accident.

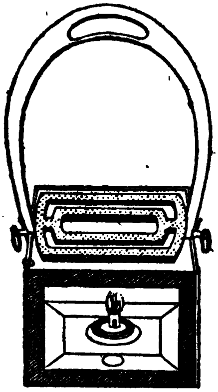
"Soon after the arrival of the vessel in Liverpool, she was docked, in order to ascertain what damage she had sustained. Some of her planks were found to have started, but her timbers were uninjured. Every instrument made of steel, such as the carpenter's tools, and the knives and forks; and also those made of soft iron, even to the very nails in every part of the ship, had been rendered permanently magnetic. All the watches and chronometers, were either stopped or rendered useless, by the magnetism imparted to the balance wheels and other parts of their works that were made of steel. Contrary to what usually happens from shocks of artificial electricity, the lightning had given a strong northern polarity to the upper part of the conductor. Many parts of the iron-work, indeed, had acquired the magnetism corresponding to their position with respect to the magnetic direction; but in others, no relation of this kind could be traced. Great changes were produced on the magnetism of the compass needles, in many of which were formed several sets of poles, and their indications could therefore no longer be relied on.

"The circumstances attending the accident which is the subject of this paper, are considered by the author, as strongly confirming the value of conductors to ships in obviating the destructive effects of lightning. From the inquiries he has made, he is led to the belief, that injuries from lightning at sea, are much more frequent than is generally imagined. One source of increased danger of late years is to be found in the greater proportion of metal, and particularly of iron, which is employed in the rigging; more especially as the metallic masses are there nearly insulated, or connected only by very imperfect conductors. In the instance before us, it is in the highest degree probable, that if the New York had been without the protection of the conductor, she must inevitably have been destroyed by the second tremendous explosion, which, thus guarded, she sustained without the slightest injury. The author remarks, that copper is a better material for such a conductor than iron, from its being less liable either to fusion or corrosion; and also, that a rod is, from its continuity, a better form of conductor than a chain. In the case of ships, however, the greater convenience of a chain, arising from its

flexibility, will generally insure it the preference. The author recommends, that, instead of carrying the conductor through the decks to the keel, as suggested by Mr. Harris, the lower end of the chain should be kept at a distance from the sides of the ship, by means of a light outrigger, or spar, as was done in the New York."

The Stirrup Lantern.

[To the Editor of the Register of the Arts and Sciences, &c.]



Sir—Being an old traveller of the equestrian order, and having experienced much comfort and convenience from the use of the Stirrup Lantern, I am desirous of recommending it to the notice of travellers generally, through the medium of your interesting work.

The Stirrup Lantern is a small square lantern, fixed at the bottom of a stirrup by means of two screw rings on each side, as exhibited in the drawing which accompanies this; they serve also to unscrew it whenever it may be required to detach it from the stirrup. The lamp part is so contrived that no oil can be spilt; nor the steady light, which is thrown across the road before the horse's feet, be at all impaired by any motion of the horse. The front part, as shown in the drawing, is of glass, through which is seen the lamp, burner, and wick; behind these is placed a reflector, for transmitting the light to the front. It is supplied with a constant current of air by means of apertures, in a sort of double casing, which are so disposed as to prevent any gust of wind from affecting the light.

This is not, Mr. Editor, an article of mere luxury, but one which confers the most solid comfort to the way-worn, benumbed, and benighted traveller. I make no doubt, indeed, that the Stirrup Lantern will be the means of saving many a neck from being broken; that my own is still entire is frequently a matter of wonder, when I consider how 'many a time and oft' I have been precipitated into hedges and ditches by some unlucky step of my horse.

In conclusion, I think it necessary to state, for the information of my brethren of the Stirrup, that I procured my apparatus of the inventor, Mr. Peat, of Piccadilly.

I am, sir, your obedient servant and constant reader,

P. Prynne.

Lambeth, 14*th January*, 1824.

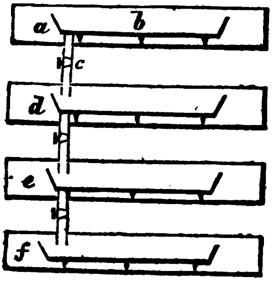
We think the Stirrup Lantern would be found particularly useful to medical practitioners in the country, when they have occasion to visit their patients at night. [*Ed. Reg. of Arts.*

New Process for Rectifying Spirit.

TO THE EDITOR.

SIR—The alkaline salts have been, I believe, employed for the rectification of spirit, as long since as the time of the learned Boerhaave, and have been adopted by all succeeding chemists, and by distillers, as the only means of obtaining absolute alcohol. A most important improvement upon this mode of rectification, without heat, it is said, has recently been made by a French chemist.

The process, I am told, consists in placing a quantity of dry muriate of lime, or other deliquescent salt, in a large, shallow, covered vessel; in this is placed another vessel of smaller dimensions, and resting on the bottom upon short legs, containing the diluted spirit (brandy, for instance) to be concentrated; the outer or larger vessel is then covered down and properly luted, to prevent the escape of the spirit. A series of similar double vessels are then arranged underneath the former, charged with the muriate of lime only; and pipes of communication leading from one to the other, are furnished with stop cocks. Those arrangements, as well as the process, will be perfectly understood upon reference to the annexed diagram.



a is the first vessel containing the deliquescent salt, *b* that containing the dilute spirit. The cover of *a* being well closed and luted, it is left for several days for the salt to attract the water from the spirit; and when the former is supposed to be fully saturated with the aqueous particles, the spirit in *b* (considerably improved in strength) is drawn off into *d*, by turning the cock *c*. This second vessel being also provided with a stratum of muriate of lime, the process of concentration recommences, by a further abstraction of the water contained in the spirit. In like manner the spirit may be successively operated upon by the salts contained in the vessels *e* and *f*, and if required by any additional number of vessels, until alcohol of the greatest purity is obtained.

As each vessel is successively emptied of the spirit, the saturated salt is taken away, and replaced with a fresh quantity of the dry salt, when it is ready to operate upon another portion of spirit let on from above. W. W——N.

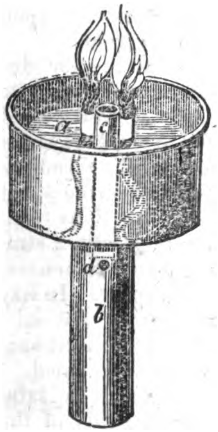
Paris. [*ib.*

Lamp for Burning Tallow and other concrete fatty substances.

THE first proposal for burning tallow in the manner of oil, which we recollect to have met with, was made by the late Mr. William Nicholson, in the first volume of his Philosophical Journal, (quarto series.) In the third volume of the same work, there is a drawing and description of a lamp for this purpose, invented by Mr. William

Close; and since that period, (1797,) numerous plans have been devised, and some patents taken out for improvements in the process. The circumstances which render such a lamp desirable, are the economical use of the fat of our kitchen, the obtaining a light without the necessity of the constant snuffing required by candles, the lessening the danger of spilling, incident to the oil lamp, and the procuring a flame from tallow for certain operations in the arts, in which it is found to be more advantageous than that produced by oil; this is particularly the case in blowing glass with the lamp.

In Vol. 4. p. 412, we have described and figured the Hon. E. Cockrane's lamp for dissolving and burning fat; one of a more simple construction has been communicated by a correspondent to the Register of Arts, who says, "It is now more than twenty years ago that I made a lamp of this kind, by which I burned tallow, dripping, goose-grease, and other solid oily matters, very effectually and conveniently; of the construction of which, I here annex a perspective sketch, should you deem it worthy of a place in your popular and interesting work. It is a simple cottage candlestick lamp, but lamps on the same principle are capable of being rendered elegant: the addition of a glass chimney would be a great improvement.

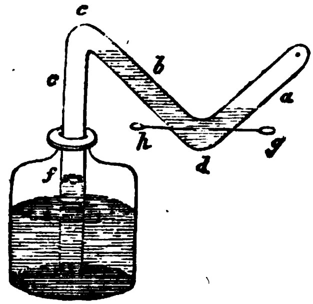


"*a* is the fat rendered fluid, lying in the body of the lamp; (the cover of the lamp being removed to show the interior;) *c* is a small tube to convey air into the middle of the flame (to perfect the combustion, on the principle of the argand burner;) this tube opens at the lower end into the large tube *b*, as shown by dots; a small perforation is also made at *d*, to allow the air to flow freely into the tube *c*, when the lamp is fixed in the socket of a candlestick. On each side of the air tube a short piece of copper pipe is fixed by hard solder, for holding the cotton wicks; these tubes (which ought to be longer) get intensely hot, and, by the conducting power of the metal, the heat is transmitted to the fat, which, melting in consequence, flows up the wick like fine oil, but infinitely preferable, on account of its diffusing no unpleasant smell during the combustion."

An Account of Mr. A. Robertson's *simple Apparatus for collecting Gases evolved from Liquids submitted to Galvanic Action. Communicated by the Author to the Edinburgh New Philosophical Journal.*

This apparatus consists of a glass tube of any size, divided into three parts, *a b c*, in the annexed figure, by the two bendings *d e*.

The upper end is closed, and the lower immersed in the fluid contained in the bottle; *f g h* are platinum wires, inserted through the tube near the bending *d*.

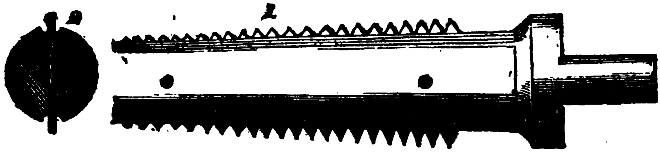


To use it—it is to be held with the part of the tube, marked *a*, nearly perpendicular, the open end being upwards, and the liquid, through which the galvanic electricity is to be transmitted, is poured in till the tube be filled. A slip of paper, a little broader than the diameter of the tube, is now to be placed over the orifice, and being extended on both sides along the tube, is to be held there, so that the whole may be inverted, without spilling into the bottle, *f*, previously half filled with the same fluid. The wires, *g h*, are then connected with the galvanic poles; and when the experiment is finished, the gas evolved at the wire, *g*, will be collected in the part of the tube, *a*, and that from the wire, *h*, at *c*, in the manner represented in the figure, the displaced fluid descending into the bottle.

The volumes of the gases may be ascertained by graduations on the tube, or they may be separately transferred into small jars, by the aid of a pneumatic trough; the gas at *c* ascending into one jar upon the tube being turned up, while the gas at *a* occupies the part of it on each side of the bend, *d*; and this, afterwards, upon a proper inclination of the tube, also ascends into another; so that each of them may be examined by itself. Should it be wished to re-combine them, it may be done without removing them from the tube, but by holding it so that the gas at *c* may rise to *b*, and join that in it, and then transmitting the electric spark between the wires.

The advantages of this apparatus, when water or any other fluid, not corrosive, is to be decomposed, consist in its simplicity and cheapness, as, by the aid of a blow-pipe, it may be made in a few minutes from any piece of glass tube of a proper size; and it possesses, also, every convenience of those which are more complicated and expensive. From the points of the wires within it being so near each other, the galvanic action is procured in its greatest intensity, and the products from each wire are, nevertheless, separately obtained. But when corrosive fluids are used, such as the nitric acid, (a substance well fitted for illustrating the action of galvanism in effecting decomposition, on account of the rapidity with which the affinity of its elements is thus overcome,) it is much more decidedly superior. The quantity of liquid used is comparatively small; there is a greater facility of filling or emptying, without coming in contact with the corrosive matter; and from there being only one opening it is more manageable, and there is much less risk of the fluid escaping from the vessels and being thrown about by the pressure of the gas produced.

Description of Mr. Siebe's Tap for cutting hollow screws.



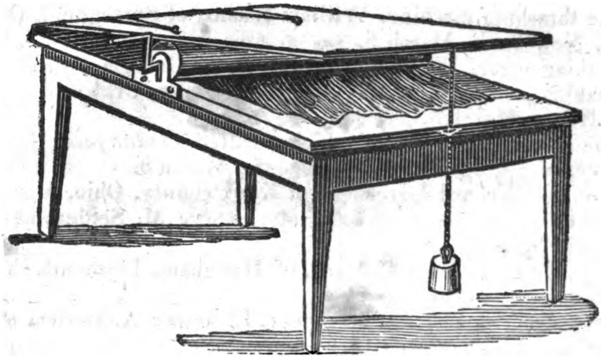
[Abstract from the Transactions of the Society for the Encouragement of Arts, &c.]

Screws vary from each other, not only in magnitude, but in the direction and complication of their threads; hence there are right and left-handed screws; also, single, double, and treble screws. The apparatus of Mr. Siebe enables the workman, with the same tool, to form either right or left, single, double, or treble hollow screws of the same diameter. The screws capable of being made by this implement are far from being mathematically accurate, but will be found to be quite as good as the hollow screws made in the usual way, and adapted to the use of various wooden articles of domestic furniture, and to the common kinds of machinery.

The Tap is a thin quadrilateral piece of steel, of the length and breadth of the required screw, having its longitudinal edges cut into saw teeth; the teeth in one row being opposite to the intervals in the other, and therefore representing a section of a screw, the teeth being sections of the threads. A cylinder of hard wood is turned, so as to correspond with the dimensions of the intended screw, and a longitudinal piece being sawn out from the middle, representing a section through the axis, the serrated plate is to be inserted, and firmly rivetted into its place. The cylinder terminates in a flat head, for the purpose of *receiving a key*, or lever, which enables the workman to overcome the friction experienced in cutting the screw.

In order to use this tool, a cylindrical hole, equal in diameter to the cylindrical stem, is to be bored in a piece of wood, and the serrated cylinder being then introduced, giving it a circular or spiral motion, will form a right or left-handed screw, according to the direction in which it is turned; and by entering two or three threads at once by means of the common V tool, the same Tap will give a double or treble threaded screw.

The hard wood being first made into a screw, the blade is rivetted in, and the teeth are made, by a file, to fit the wooden threads; the blade is then removed, the threads in the wooden cylinder are then turned off, leaving the stem a smooth cylinder; the blade is then tapered at the point so that the first teeth are no bigger than the cylinder; it is then rivetted again in its place, and the instrument is complete, as exhibited in fig. 1. Fig. 2 is an end view of the same, which is exhibited to show that the cylinder is cut away a little, where the teeth are inserted, to make room for the shavings; as the cylinder fits the hole, and the blade is taper, a gradual and steady cut is secured, which may either be to right or left hand.



Description of a Cheap Mangle.

The above is a sketch of a simple apparatus, which answers the purpose of a *Mangle.* It consists of a roller, about four inches in diameter, and thirty inches long, with a piece of the thick woollen cloth used for ironing upon, firmly fixed thereon, which is held upon a table by two strong iron plates, and turned round by means of a winch; upon this rests a board, the length and width of the table, secured to it at one end with hinges, and with a weight suspended from it at the other, the pressure of which, upon turning the winch, winds the woollen cloth, and the damp linen articles laid upon it, so tight upon the roller, that by continuing the motion, the linen becomes as smooth as by the common unwieldy mangle. The roller rests upon the table, and the iron plates allow it to rise or fall, according to the quantity of clothes wrapped round it.

[*Ed. Reg. of Arts.*

AMERICAN PATENTS.

List of Patents granted in the United States, in March and April, 1828.

FOR INVENTIONS AND IMPROVEMENTS.

In the grist mill, Samuel Holland, of Hanover, Columbiana County, Ohio, March 1.

In the thrashing machine, Michael First, Union Town, Maryland, March 3.

In the cooking stove, Daniel G. Garnsey, of Pomfret, Chanutaugue County, New York, March 3.

In making carriage bodies, called self-bracing bodies, Jesse Reeder, of Lebanon, Warren County, Ohio, March 4.

In the mode of curing tobacco, Martin Baker & Thomas Baker, of Louisa County, Virginia, March 4.

In the lever for working horse mills, &c. John Galbraith, of Maury County, Tennessee, March 6.

In making tongs of cast iron, Enos H. Buell, of Marlborough, Connecticut, March 6.

In the thrashing machine, William Looms, of Springfield, Oswego county, New York, March 6.

In making sugar, William J. M'Intosh, of Georgia, March 7.

In making paper, Wm. Magaw, of Meadville, Crawford County, Pennsylvania, March 8.

In the machine for raising vehicles, called *the tar jack*, Hezekiah Salisbury, of Springfield, Massachusetts, March 8.

In ploughs, Richard Loveridge, of Knox county, Ohio, March 8.

In the tide pump basin or reservoir, George M. Selden, of Troy, New York, March 10.

In the plough, Charles Howard, of Hyngham, Plymouth County, Massachusetts, March 10.

In generating steam, gas, or vapour, Ebenezer A. Lester, of Boston, Massachusetts, March 10.

In water power to the propelling of machinery generally, George Morgan Gibbs, of Prince William Parish, Beaufort District, S. C., March 10.

In the machine for bending sheet iron for steam engines, boilers, &c., Calvin Post, of Spring Port, Cayuga County, New York, March 11.

In manufacturing cast iron shoes, for sleighs, &c., Ichabod Arnold, of Oswegatchie, New York, March 12.

In the grist mill, Admiral Warren, Saugerties, Ulster County, New York, March 12.

In the machine for boring rocks, Israel Overall, of Liberty, Smith County, Tennessee, March 14.

In carriages, Thomas Knox, of Sniggersville, Loudon County, Virginia, March 15.

In the application of steam, Joseph Skinner, of Mantua, Portage County, Ohio, March 14.

In propelling boats or carriages, Timothy Davis, of Lawrence, Dearborn County, Indiana, March 15.

In the construction of wash-stands, John Williams, Baltimore, March 15.

In the trip hammer, Levi Rosenkrans, of the town of Big-flat, Tioga County, New York, March 17.

In the machine for shelling corn, John Brown, Providence, Rhode-Island, March 18.

In piano fortes, C. F. L. Albrecht, of Philadelphia, March 18.

In moulding and finishing bricks, David Flagg, jr., Gardiner, Maine, March 21.

In the washing and churning machine, Rufus R. Palmer, Caroline Township, Tompkins County, New York, March 21.

In the satinett power loom, Richard Mitchell and Nathaniel Butterworth, Troy, Bristol County, Massachusetts, March 22.

In the mode of applying the archimedian screw in raising water, Perry Harris, of Preble County, Ohio, March 25.

In the evolution and management of heat, Eliphalet Nott, of Schenectady, New York, March 26.

In grinding bark, called the bark grinder, Aaron Bull, Caroline, Tompkins county, New York, March 27.

In the washing machine, do. do. March 28.

In boring pump logs and aqueducts, Samuel Draper, of Camillus, Canandagua County, New York, March 31.

THE

FRANKLIN JOURNAL,

AND

AMERICAN MECHANICS' MAGAZINE;

DEVOTED TO THE

USEFUL ARTS, INTERNAL IMPROVEMENTS, GENERAL SCIENCE,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

AUGUST, 1828.

On the blowing of Air into Furnaces by a Fall of Water. By the late William Lewis, M. D.

[Continued from p. 16.]

EXPERIMENTS OF THE PROPORTIONAL BORES OF THE FUNNEL AND PIPE.

We have already seen, that unless the throat of the funnel is less than the pipe, the quantity of air carried down will be inconsiderable; and that by lessening it further than to a certain point, the effect is also diminished. To hit this precise point is not perhaps possible; and the point which is the most perfect proportion for one height of water, cannot be so for any other; an increase of the pressure, disposing the jet to spread more, and fill a larger bore.

It appears from some experiments already mentioned, that when the whole height of the fall of water is fifteen feet, the height of the pipe ought to be nine feet, and that of the funnel six. This being as low a fall as these kinds of machines have generally been erected for, and as high a one as is generally to be expected in this country, I made several trials for adjusting the proportions to those heights; using for the funnel, a tapering copper pipe, into the lower end of which were occasionally inserted smaller pipes, of different bores.

By trying several of these funnels we came to certain sizes, which could not be much increased or diminished, without diminishing the effect of the machine; but if there is, in this respect, any exact standard, our experiments did not discover it. There are so many circumstances, as we have already seen, which influence the effect, that it is very difficult to judge, when the differences are small, how far they depend on any particular one. When the area of the orifice of the pipe was from four to five times greater than that of the funnel,

the differences in the height of the gauge were not very considerable: the due proportions seem to lie within these bounds; and perhaps nearer to the latter than to the former; for when the funnel was only about the sixth part of the area of the pipe, the gauge stood rather higher than when it was a third part; from whence, the proportions should be as one to somewhat more than four and a half.

Experiments of dividing the stream, so as to increase its effects, and render less water sufficient.

As the effect of these kinds of machines depends on the water being spread and divided; and the air, which comes in to fill the interstices between the little streams, or drops, which compose the jet, being pushed down with velocity, by the succeeding water; I have endeavoured to divide the stream more effectually than is done in the common machines, and with little or no diminution of its velocity, by varying the form of the aperture of the funnel.

On the orifice of the funnel, I fitted a perforated tin plate, like the nose of a watering pot, but with the holes larger, and of a triangular figure; this figure was chosen on account of its great surface; water passing through a triangular aperture having about a third part more surface than through a circular one of equal area: some more holes were made round the sides, in such positions that the streams issuing from the higher holes might no where fall upon, or coincide with those from the lower ones; but that the water might be uniformly dispersed through the whole cavity of the pipe. By this division of the water it was made to fill a much larger bore than otherwise, and to produce as great an effect as the full quantity of water which the same pipe would otherwise have required; insomuch, that quantities of water which had little effect in the common way of application, were by this contrivance, made to yield a strong blast.

This method is, however, accompanied by an inconvenience, which often showed itself in the course of the experiments; and which must be more considerable, in the continued working of the machine. After it had acted vigorously for some time, its action frequently abated of a sudden; the blast from the blowing pipe grew weak, and the gauge sunk: sometimes its force increased again in a little while; but, for the most part, it continued to diminish more and more. The cause was discovered to be bits of leaves, and other like matters, which the water had carried into the funnel, and which had in part stopped up the small apertures. The remedy was obvious, letting the water pass from the reservoir through a wire sieve, whose holes were much finer than those of the funnel; and doubtless an expedient of the same kind would prove effectual for the largest machines. It is in all cases adviseable, to have the water pass through a grating before it enters the funnel, even the common large apertures being sometimes choked up, by matters which the stream brings along with it. Where scantiness of water, or want of so high a fall as is commonly required, persuade to this contrivance for procuring a more effectual division of it, and for augmenting its power, with its surface, two or three gratings, or perforated planes, with apertures of

different sizes, will be necessary; one, with very fine holes, much smaller than those of the colander; that nothing can get through the former, which can be in danger of sticking in the latter: another with larger apertures, for detaining weeds and such other matters as would soon obstruct the finer strainer.

I have tried other methods of procuring this dispersion of the water, by making the throat of the funnel of different figures, but with little success. Whether the throat was made converging or diverging, in greater or lesser degrees, there did not appear to be any material difference in the effect of the machine. I introduced into the funnel a cylindrical core, which was fixed in the middle of it, by means of pins projecting from it, so as to leave a circular aperture all around it; and this core was sometimes solid, and sometimes a pipe, which reached above the funnel, and carried down air into the middle of the jet below; but no other difference was observed in either case, but what arose from the necessary diminution of the quantity of water. It is probable, indeed, that by duly proportioning the core to the funnel, and the width of the pipe to the sheet of water, falling round the core, the effect, by the division of the stream, would be greater than an equal quantity of water would produce when falling in one column; though the increase obtainable by this method did not promise to be considerable enough to deserve the troublesome investigation of the proportions. One trial, however, depending partly on this principle, appeared of some importance to be made.

As the water-machine of St. Pierre is said to have two apertures in the bottom of the funnel, whose streams as they issue out cross one another, and are dashed into drops, I tried to answer this intention by using for the funnel a wooden trunk, with two of its sides sloping downwards so as to leave a long narrow aperture between them; in the middle of this aperture, and parallel to the inclined sides, was placed a wedge, of the same slope with the sides of the funnel, that the water might pass out in two sheets, directed towards one another.

The funnel was, at top, about eight inches square; its width at bottom, seven inches and eight-tenths, by one inch and nine-tenths. The wedge dropped into it entirely stopped the lower aperture, and had its thin edge hanging down considerably below it: slips of wood of different thicknesses fastened on the wedge occasionally, two on each side, prevented its falling down so far, and procured spaces of different widths, between it and the sides of the funnel, so that the water could be reduced at pleasure into two sheets, seven inches and eight-tenths wide; and from less than a quarter of an inch, to three-quarters of an inch thick; the partition in the middle reaching in all cases lower down than that which confined them on the sides, that they might not unite into one, upon their discharge from the throat. Along the sloping sides of the funnel were two air-pipes, of the same breadth with them, and about an inch and a half wide; so that at the bottom there were three oblong rectangular apertures; the middle one with a wedge in it for the water, and the two lateral ones for air;

the outsides were continued about seven inches and a half below these apertures, so as to form a large cavity for the water to spread in.

The funnel above the throat was somewhat more than three feet high; on the top was fitted a wooden pipe, nearly of the same width with it, and four feet eight inches high. The top of this pipe passed up through a rectangular cistern, nearly 168 inches in length, and 96 in width, and which consequently contained about fifty-seven gallons on every inch in depth. For admitting the water, two holes were made, in two opposite sides of the pipe, about ten inches high, with two sliders fitted to them, for occasionally varying their height; and, consequently, the quantity of water received. On the outside of each hole was fixed an iron plate, perforated with numerous small holes, to keep back such matters as might choke up the throat: that the holes might be sufficient to allow water enough to pass in, the strainer was made wider than the aperture in the pipe, and bent to a semi-cylindrical form.

To the bottom of the funnel, enlarged as above-mentioned, was fitted a pipe, six feet high, and in width four inches by seven and a half. The lower end of this pipe was inserted into the head of a large cask, without a bottom, which was set in a tub above three feet deep, with three supports under the lower edge of the cask, to procure a space between it and the bottom of the tub, for the water to pass freely off. About eight inches under the orifice of the pipe, a round board, for the water to fall upon, was hung by three cords, which passed up through the head of the cask, and were secured by pegs. At one side, a tin vessel, full of water, was supported in the same manner; and through a faucet, over the middle of this vessel, was inserted a glass tube, thirty-four inches long. At the other side was the blast-pipe, about three-quarters of an inch in diameter.

The machine being thus prepared, we proceeded to the trial of it, expecting that the two streams, from their strong direction towards one another, would cross, and be dashed into drops, and carry down abundance of air. But in the effect we were greatly disappointed: the blast was weak, and the gauge rose to no considerable height, whether the wedge was dropped down or raised up, so as to suffer the water to pass in lesser or greater quantity, in thin or in thick sheets; in continued trials and variations of the apertures for three or four days, the gauge was not once observed to rise so high as ten inches. A good deal of air, indeed, escaped through the junctions of the pipe, and of the air vessel; but not near enough to make up the expected quantity.

The wedge answering so ill, it was laid aside; and in its place was introduced a leaden vessel, of the same shape with the funnel's throat, and of such a size as to rest against the sides of the aperture, by its upper edge, and hang six or seven inches down in the wider part of the pipe: in the sides and bottom of this vessel were made several holes, about two-tenths of an inch in diameter. With this alteration I had the pleasure to find that though air rushed out from the joints, even more plentifully than before; yet the blast from the blowing-

pipe was strong, and the water in the gauge-pipe rose to the top, and ran over.

I tried to measure the quantity of water necessary for producing this effect, for a certain time. The reservoir being filled to the depth of fourteen inches, the gauge rose as before, and continued high for four minutes; after which it began to sink fast; the water in the reservoir having then become too low to keep the pipe full, though it continued to run for a considerable time longer. From the dimensions of the reservoir already mentioned, it will appear, that if all the water had run out in the four minutes, it would have amounted to near two hundred gallons in one minute; but at least a fourth of it remained after that period; so that the expense could not exceed a hundred and fifty gallons in a minute. We could not expect any very great accuracy in this determination, because, as the height of the water continually decreased in the reservoir, its velocity likewise decreased; so that if a due quantity run in the last minute, a superfluous quantity must have run in the first.

The leaden colander being taken out, and the whole throat left vacant for the stream, the gauge still rose to the top; but the expense of water was now more than double to what it was before.

These trials, though not carried to such a length as I could have wished, satisfied me and those who assisted at them, that much more air is to be obtained by dividing the stream by means of a colander, than by any other methods that have been tried; and that *with such a machine as is above described, a stream of a hundred and fifty gallons, at most, in a minute, is sufficient to produce a continued blast, from a pipe of three-quarters of an inch bore, of such a strength as to support a column of water of three feet or more.*

To afford as much assistance as possible to those who may be desirous of erecting machines of this kind, I shall here collect into one view the most material particulars which my experiments have discovered, with regard to the perfection of their structure; and form from them a description of such a machine as promises to be most effectual.

The bottom of the reservoir of the water should be about fourteen feet above the level of the ground; we need not be very solicitous about procuring a greater height; for though a greater would be of some advantage, yet this advantage appears to be much less considerable than has been commonly imagined. In the channel by which the water is conveyed, are to be placed gratings of different sizes, as already mentioned; and before the aperture a finer grating, which may either be a perforated iron plate, or a wire sieve, to serve as strainers for keeping back such matters as would obstruct the apertures which the water is afterwards to pass through. The stream should enter at one side, or be so managed that the water in the reservoir, or funnel, may not be agitated by it, or put into a spiral motion, which our experiments have shown to be very injurious.

In the bottom of the reservoir is to be made a round hole, for admitting the upper end of what we have hitherto called the funnel, but which may here be more conveniently a cylindrical pipe of copper or of cast-iron, five or six inches in the bore, and seven feet long.

To the end of this pipe is to be fitted a colander, about a foot long, with the holes triangular, of about half an inch on each side; and six or seven stripes from top to bottom, at equal distances, preserved without any holes, for admitting air to pass down to the lower streams. All the holes should be directed downwards, that the streams may not be forcibly projected against the sides of the pipe which is to receive them, so as to have their velocity too much diminished.

If there are six of the perforated spaces in the colander, the number of holes in each may be twenty, so that the whole number of holes will be one hundred and twenty. The side of each of the triangular holes being half an inch, the area of which will be the eighth part of a square inch; and the sum of their areas will be fifteen square inches. The quantity of water running through one aperture of such an area, at the depth of seven feet and a half under the surface, comes out, on calculation, about six hundred and twenty-two gallons in a minute; but the real quantity will doubtless be much less than this, on account of the great friction of the water, in passing through a number of small holes, and of the resistance of the air, which increases in a very high ratio, according to the increase of the velocity, and enlargement of the surface; it is in part to make up for these retardations, that the pipe is directed to be made so high. The surface of the water is here above thirteen times greater than if it passed all through one circular aperture.

Both the pipe and the colander should have a flanch, or rim, round their orifices; and be secured to one another by screws passing through the rims of both, with a plate of lead between them, to make the juncture tight, as commonly practised in joining iron pipes for water-works. This way of joining them permits the colander to be taken off and cleaned, when a diminution of the effect of the machine shows the holes to be choked up; which, however, it is apprehended will seldom happen.

As the holes will permit more water to run through than may at all times be wanted, it is proper to have some contrivance for occasionally closing a part of them. This may be effected by means of a thin copper pipe, open at both ends, as high as the colander, and of such width as just to drop into it. It will be easily conceived, that when this register is let entirely down, the lateral holes will be covered, and the water admitted only to those in the bottom of the colander; and that by raising it further and further, more and more of the lateral holes will be uncovered. The register is to be hung by a wire, to a cross bar over the reservoir, by which wire it may be raised and lowered, and a scale or divided board, may be adjusted against the upper part of the wire, for showing the height of the register, or the number of holes closed by it.

The most commodious and effectual way of admitting air to the water, appears to be that of our first experiments, viz. hanging the throat of the funnel, in this case, and the colander, within the wider receiving pipe; for by this means the air is admitted freely and uniformly all round. This last pipe should likewise be of iron or copper, twelve inches in diameter, and spread out at top to the width of

sixteen or eighteen inches, that a large space may be left round the colander; this space should reach three or four inches above the uppermost perforations of the colander, to prevent any of the water from being dashed over the top.

A pit is to be sunk in the ground, not less than six feet deep. In this is to be placed an air-vessel, made of wood, lined with lead, without a bottom, three or four feet in width, and ten or eleven high. The vessel should be supported on feet, of a proper strength, with sufficient spaces between them for the water to pass freely out; this way is preferable to the common one, of placing the lower edge of the vessel on the bottom of the pit, and cutting an aperture in the side, because the height of the aperture, is so much taken off from that of the vessel. The reservoir being fourteen feet above the ground, and the upper pipe and colander reaching down eight feet, only six feet remain below the colander; so that the air-vessel being sunk six feet in the ground, will reach nearly up to the colander; and almost the whole height of the undermost pipe will be included within the vessel. This pipe may be above nine feet long, three feet or more of it going down into the pit, which three feet are here an entire gain in the height of the fall; for the pipe, in other machines, comes at most no lower than the level of the ground, where the water runs off on the outside. This height is gained, in virtue of the compressed air in the vessel, pushing down the water below, as already shown: it may be always as great as the height to which the water is intended to rise in the gauge. At the distance of five or six inches, under the orifice of the pipe, is to be placed the concave iron plate or stone, for the water to fall on. In the top of the air-vessel is to be fixed the gauge and the blowing pipe.

Such is the general construction of the blowing machine, which promises to be particularly useful in cases where water is scarce; or where the want of a natural fall renders it necessary to raise, by very expensive means, the great quantities requisite for working the common bellows. It is presumed, that one of these machines will be sufficient for the iron forge, and for sundry other purposes, where the quantity of air is not required to be very great; *that it will be less expensive on account of the durability of its materials, and the simplicity of its structure, than any kind of bellows now in use; and, what is of principal importance, that much less water will serve for working it.* In cases, where one of the machines cannot supply air enough, as for the large iron smelting furnace, two pipes may be used, both fed by one reservoir, and entering into one air-vessel, as practised in some of the instruments described in the beginning of this article. The use of two pipes appears more eligible than enlarging the bore of one; for air cannot be so freely introduced into a large body of water, though divided by the colander, as into two smaller ones of equal quantity.

It may be observed, that the blast will be stronger in a dense state of the atmosphere than when it is more rare or expanded, a greater quantity of air being then introduced under an equal volume. If, therefore, the quantity of water has been adjusted so as to raise

the gauge to a proper height, when the air was light, it will frequently happen that the same quantity of water shall raise it higher; and consequently, if no greater height is required, that a part of the water may be saved. As the gauge of our machine discovers, by inspection, these variations in its effect, the register affords convenient means of regulating its power, and increasing or diminishing the quantity of water.

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*On the preparation and uses of the Animal Charcoal, known, usually, under the name of Ivory-black, or Bone-black, and especially on its use in refining sugar.**

For some years past, the denomination of *Animal Charcoal* has been given to that particular kind of carbonaceous matter which remains on distilling the bones of animals in close vessels, at an elevated temperature (viz. a little above a cherry-red.)

This charcoal, which may be applied to several different purposes, as hereafter mentioned, is more especially employed to remove the colouring matter combined with various substances, such as the coarse sugars obtained from the cane, or beet-roots.

The discovery of the antiputrescent and bleaching properties of charcoal in general is due to Lowitz; but many others have been engaged, since his time, in bringing to perfection the method in which he first applied it to use.

M. Kels published, in 1798, several essays, on the perfect *decolouration* of indigo, saffron, turmeric, and black sirops, by means of powdered charcoal. He announced, that the charcoal of bones would remove the colour from these substances; but he was deceived respecting its decolourating power, which he had considered to be inferior to that of common vegetable charcoal.

In the *Annales de Chimie* for 1800, is a notice by M. Scaub, of Cassel, relative to the use of vegetable charcoal in the bleaching and purifying of honey, the sugar of the beet, &c.

The first useful application of charcoal in refining raw colonial sugars was made by M. Guillon. This eminent refiner sent into the market considerable quantities of bleached sirops, which he prepared by means of the charcoal of wood, powdered. The agreeable taste of these sirops soon caused them to be preferred to the moist sugars, then used in France in great quantities. M. Guillon's example was soon generally followed, and all the sugar-refiners employed the same process.

In 1811, M. Figuier, a chemist of Montpelier, published a notice on animal charcoal; stating, that this charcoal decoloured wines and vinegars much better than vegetable charcoal. He attributed this property, unjustly, to the gelatine which he supposed to exist in the animal charcoal; for it no longer contains the least trace of gelatine, when it has been calcined.

* Translated from the *Dictionnaire Technologique* for the Technical Repository.

Lastly, in 1812, M. Charles Derosnes thought that he could usefully employ the decolouring property, which M. Figuier found to be so powerful in animal charcoal, as a substitute for the vegetable charcoal, in the manufacture and refining of sugars; and a few experiments confirmed the propriety of his application. He imparted his project to my father and myself. The large quantities of carbonaceous residuums obtained from the distillation of bones, in our manufactories of sal-ammoniac, gave us an opportunity of preparing this charcoal at a trifling expense; and we soon united our efforts with his, to substitute the animal for vegetable charcoal, in all sugar-refineries. M. Pluvinet assisted us in this new undertaking.

The mode of operating which we recommended to sugar-refiners still presented, however, some difficulties in its application on a large scale: these I found the means of removing; and very soon the new method of refining became more simple and easy; and, being classed with the common operations of the manufactory, almost wholly excluded the former ones, in all the towns of France. We shall not be surprised at this rapid success, if we observe, that every thing else remaining the same, we could obtain, by the new process, ten parts in the hundred more of crystallized sugar than in the former mode of operating; and, what was of still greater importance, the refined sugar was whiter; and all the secondary products, such as the browner lumps, the molasses, &c., had a better taste, and were more saleable.

On its preparation.—The animal charcoal is prepared from the bones procured in large cities, and particularly at Paris, where the consumption of meat is very great.* A great number of persons collect bones throughout large cities, among the refuse of other substances; and also the bones from kitchens, which are thrown into the streets. Shopkeepers, such as the dealers in marine stores for instance, buy them, and send them to the melters; who, after having extracted the fat or grease from the bones, sell them to the manufacturers of ivory-black and sal-ammoniac.† These boiled bones require to be heated in close vessels; which operation is performed by two different processes. With the bones, broken to pieces, they fill large iron cylinders placed horizontally in a furnace; which are

* According to a work published in 1821, by order of *M. le Comte de Chabrol, Préfet* of the Seine, entitled *Recherches Statistiques sur la Ville de Paris et le Département de la Seine*, &c., the consumption of meat in that city, extracted from the registers of the *Octrois*, the results of the sales at the markets, and other authentic documents, amounts, annually, on an average of ten years, to 42,716,800 kilogrammes; which nearly equals *Lavoisier's* account. If we add to it the consumption in the suburbs, and the parts adjacent to the barriers, and also the horses slaughtered, the bones of which may be also used, the total weight may be estimated at 48,000,000 kilogrammes, containing about 12,000,000 kilogrammes of bones; about two-thirds of which are lost; for there are gathered for the manufactories of sal-ammoniac and ivory-black, at the utmost, 4,000,000 kilogrammes in a humid state, which produce only about 2,000,000 kilogrammes of manufactured ivory-black.

† These persons, for their own consumption, also treat the greasy bones in a particular way, so as to obtain a good fat from them.

adapted, by means of a tube of three inches in diameter, with a long range of a refrigeratory apparatus.

The temperature is gradually raised, till the vessels become of a cherry-red heat; at which they are kept for thirty-six hours; when the charcoal is withdrawn from the cylinders, to be instantly inclosed in the extinguishing-boxes. It is sufficient, then, to leave it to cool, and to reduce it into very fine powder.* The greater part of the animal black is prepared in this manner.

The second process consists in carbonizing the bones in cast-iron pots, used in pairs, the one being inverted upon another; so that they assume nearly the form of a cylinder terminated by spherical ends. The joints are luted with loam. The cracks, caused by the contraction which the loam experiences in the fire, are sufficient for the escape of the vapourized water, the empyreumatic oil, and the gases resulting from the decomposition of the animal matters; such as hydrogen, carbonic acid, oxygen, and azote, either separate or combined, two and two, three and three, or in other varied mixtures, during the different periods of operation. The temperature of the whole soon becomes sufficiently elevated for the disengaged volatile products to be inflamed, and thus to assist the operation, by uniting with the fuel to produce heat. When the carbonization is complete, and all the volatile products are disengaged, the furnace is allowed to cool, so that a man may enter it: the brick-work door of the furnace is then broken down, and the cast-iron vessels are emptied: the bone charcoal they contained is pounded in the dry state, and is then ready for sale.

Thus, as we have before stated, the use of vegetable charcoal, in the refining of sugars, preceded, and finally led to, the application of animal charcoal to the same purpose; the strength of the latter being much more considerable, although it contains a much less proportion of pure carbon. We must therefore infer, that it possesses a particular decolouring principle, which, however, it would be a vain endeavour to describe.

The immense advantages which this animal charcoal possesses, in its application to the refining of cane-sugar, and the preparation of sugar from the beet, raised fears of not being able to obtain a sufficient supply, and a desire of finding out another article which might be substituted for it. The Society of Encouragement proposed a prize of 2000 francs for solving of the problem; and the Paris Society of Pharmacy proposed another, on the question of the mode of action of the animal black, for the purpose of throwing some light on the problem which engaged public attention. Several Memoirs, presented at the meeting of the Society of Pharmacy, were approved by a special commission. In fact, the researches of all the different competitors ended in the same theory. Two of these Memoirs were successful; that of M. Bussy and my own. I will extract what I have yet to add, from this latter Memoir; in which I am also bound

* In order to obtain more constant results, I employ for this operation, in my own manufactory, the power of a steam-engine to work the mills.

to resolve some questions, not indeed contained in the *programme*, but which appear to me to be called for by the manufacturers, to whom the animal charcoal is of the first consequence.

Without entering into a detail of the experiments therein contained, I shall present the useful results which appear to me to be demonstrated in this Memoir.*

The phosphate of lime is, in general, one of the principles found, by analysis, in the animal charcoals, (the pure carbon excepted:) but either when alone, or in double or triple combinations, it presents no other properties than those of simple carbon.

Animal charcoal acts the better, as it is more divided, and as its carbonization is the more complete; and especially when a certain degree of temperature has not been exceeded, during its carbonization. Its energy is increased, when it is freed from some of the soluble substances which generally accompany it.

The foreign soluble vegetable substances in sugar, which accompany the colouring matter, are also removed by the action of the animal charcoal, in the treatment of solutions of new sugar. This effect, doubtless, contributes to increase the quantity of crystallized sugar obtained.

The *carbon*, when freed from the substances which accompany it in animal charcoal, and particularly from the phosphate and carbonate of lime, by means of the hydrochloric acid and numerous washings, acts much more powerfully upon the colouring matter of raw sugar, than the crude animal charcoal does, in equal weights. This substance may, therefore, be considered as the active principle in animal charcoal.

If we were to calculate thus, in order to verify the exactness of these properties; namely, that ten parts of this *pure* carbon were as active as 100 parts of the crude charcoal from which it was extracted; we should find that this is not the case, but that the *pure carbon* possesses a decolouring power only three times as great as that of the crude animal charcoal. Now, as the latter contains only 0,1 of carbon, we may conclude, "that, by extracting the sub-carbonate and phosphate of lime from the animal charcoal, we sustain a real loss in its decolouring action, in the proportion of ten to three, or seven-tenths."

It appears, according to these results, that the decolouring power is not solely confined to the *carbon:* it has, nevertheless, been demonstrated, that it could not reside in any other substance. In order to explain this apparent anomaly, we may be allowed to suppose, that, without acting directly, the foreign substances in the charcoal of bones may serve as auxiliaries to the carbon, in retaining its molecules in a state of division, and thus presenting them to the colouring matters in a kind of chemical division; and other results confirm me in this opinion.

I am well convinced that all charcoals, whether from animal,

* *Théorie de l' Action du Noir Animal sur les matières colorantes, et dans ses applications à la fabrication et au raffinage du sucre.*

vegetable, or mineral substances, and however accurately they may be divided mechanically, have very little effect on colouring matters, when, after carbonization, they present *brilliant surfaces;* such as the ordinary charcoals of wood, horn, muscular flesh, sinews, leather, and, generally speaking, of all the softer parts of animals; and also those of bitumen, pit-coal, &c. The *animal charcoal from bones* also becomes less active, when, in calcining, it is mixed with any animal, vegetable, or mineral matters susceptible of being fused during the carbonization; as they cause the surfaces of the bone-charcoal itself to be covered with a kind of carbonaceous varnish, which paralyzes its decolouring action, by clogging up, or binding the molecules of the carbon closely together. An instrument which I have lately had constructed, assists me in appreciating, comparatively, the decolouring powers of the different kinds of charcoal.

It is clearly proved, therefore, that those charcoals which present *brilliant surfaces,* whatever be their origin, possess very little energy on colouring matter.

I have shown, by a great number of experiments, that the same substances which directly form brilliant charcoals may be treated so as to produce very active dull charcoals. Thus, in calcining, at a red heat, blood previously dried with pot-ash, as in the preparation of Prussian-blue, we obtain a carbonaceous residuum, which, when freed from the soluble salts it contains, possesses an extraordinary decolouring power, ten-fold greater than *ivory-black.* But, to say the truth, we have not yet been able to prepare this charcoal, so as constantly to arrive at the same perfection: I have in vain attempted it, when operating in the large. In fact, I have declared it as my opinion, that if the *ivory-black* which has been already used could be cleared from the animal and vegetable substances with which it thereby becomes mixed, it might, by a fresh carbonization, be restored to its primitive energy.*

It follows, therefore, as I have before stated, that *brilliant* charcoal does not possess a good decolouring quality, and that all the most active charcoals *have a dull appearance.* The established distinction, then, between *animal charcoal* and *vegetable charcoal,* as respects their decolouring properties, is wrong; and it would be better to distinguish them by the appellations of *dull* and *shining* charcoal.

The modifications above mentioned, which render inert-charcoals active, and *vice versa,* appear to me to prove, that the decolouring action of charcoals in general, depends on the particular state in which the carbon is found in them—a state which, where the char-

* I have pointed out various means by which I have succeeded in obtaining these results. One of them may be applicable to the Colonies: it consists in producing a fermenting action, by collecting the ivory-black-deposits into large masses, and keeping them at a high temperature (of from twenty-five to thirty degrees,) they are then washed in a large quantity of water; dried in the air; and again subjected to the action of heat. In this manner, by operating with some precautions, we obtain an ivory-black of a good quality, which may be used a second time.

coals possess very great energy, may be considered as a kind of chemical division.

In the application of *animal charcoal* and *vegetable charcoal* to the refining of sugar, we have observed some apparent anomalies, with which I have endeavoured to make myself acquainted. I have observed, that animal charcoal, but little carbonated, acts better in acid and viscous sirops; because the great proportion of ammonia which it contains, independently of the carbonate of lime, saturates the acids formed, and, by its excess, destroys their viscidity. The molasses and sirops, being more fluid, run better, and the sugar is whiter; although this charcoal may be for ordinary purposes much weaker than charcoal sufficiently carbonated.

In the manufacture of sugar in the Colonies, and of the sugar from the beet-root, a considerable quantity of lime is employed to *defecate* the juice: the excess of lime, which remains in solution in the liquid, re-acts upon the sugar during the whole time of its evaporation, and renders a great part of it uncrystallizable. In the refining process, where lime is also employed, under certain circumstances this agent is equally serviceable, in fulfilling the end desired; and is also injurious when in excess: it is therefore very important to be able to arrest its improper action in time. It would be difficult to do this by means of an acid, or an acid salt; because the least excess of either of these substances would be more dangerous than the action which we wish to prevent. Animal charcoal possesses this useful quality: it completely saturates the lime: this I have clearly proved. Thus, if we take 100 grammes of distilled water saturated with lime, and boil it for an hour with 10 grammes of the common animal charcoal; or even wash it well with boiling water, and then throw the whole on a filter; the clear liquid will not be rendered turbid by the oxalic acid, or the oxalate of ammonia—re-agents, by which we may discover the smallest possible quantity of lime in solution. No satisfactory theory has yet been given of this action; which charcoals, not containing *phosphate of lime*, have not seemed to me to produce: and this, probably, is the principal cause of their inferiority, as respects the purposes which we are now discussing.

Animal charcoal, on account of the sub-carbonate of lime it contains, may also completely remove the excess of acid in sirops; it has therefore the double property of saturating both the lime and the acids.

According to the results, above cited, of a work of Lavoisier's on the territorial riches of France; or those of a more recent statistical work, published by order of M. le Comte de Chabrol; I think we may be able to ascertain, that the quantity of bones afforded from the consumption of meat, in Paris and its environs alone, would be more than sufficient to manufacture animal-black necessary for the refining of all the sugar which we consume annually; and, in fact, that the animal-black now manufactured is more than sufficient for our refineries. I am at this moment engaged in devising the means of exporting to our Colonies the excess of this manufacture.

When the advantages which the use of animal charcoal presents,

in the preparation of raw sugar in the Colonies, shall be known, its use will doubtless become of more importance: but we may be allowed to hope, that, by employing it twice over, the quantity which we can export will be found sufficient. This induces me to add a few observations, on the secondary employment of animal charcoal, by revivifying it.

I have pointed out, in this article, a possibility of restoring to the animal-black, which had been once used, its primitive energy; but I have also remarked, that it cannot be effected with economy.* It is probable, that particular circumstances may be favourable to the application of a part of this process in the Colonies. It appears to me possible to act upon it in the following manner:—the thick black-deposits remaining upon the filters may be daily collected into one mass, and be put into a covered trough, or any other large and covered reservoir, and be allowed to ferment; which it will not be slow in doing, in consequence of the sugar, and other vegetable matters, remaining in the charcoal. When the alcoholic acid, and even the putrid fermentations, have terminated, it must then be subjected in closed cast-iron cylinders, for several hours, to a red heat. The carbonaceous powder must then be ground afresh in a horizontal mill; and thus an animal black will be obtained, very little inferior to the original black employed;—which will be productive of very great advantages; as the animal charcoal becomes extremely dear in the Colonies, in consequence of the expense of its importation.

Animal Charcoal, in an impalpable powder, may be usefully applied as *a facing* to moulds for making iron or bronze castings: I have also used it with success in the cementation of delicate pieces of iron, to convert them into steel: it forms *ivory-black*, *bone-black*, &c.: it is spread upon land, as a manure; and assists vegetation, even after being used in the refineries, &c. It is employed, not only in the preparation of sugar, but also to remove the colour of various extracts, whether siropy or saline. P.

On the preparation of the Silver-gilt Wire, used in the manufacture of Gold Lace, and for other purposes. Extracted from Dr. William Lewis's *Commercium Philosophico-Technicum.*

There is very little wire made entirely of gold; and this chiefly for one particular purpose, that of filligree work. What is commonly called gold-wire has only an exterior covering of gold, the internal part being silver. A rod of silver, above an inch thick, two feet in length, and weighing about twenty pounds, is coated with

* The *Society of Encouragement*, at its last annual sitting, voted a prize for the revivifying animal-black employed in sugar-refineries; but the process has not yet been published. At any rate, the decolouring strength of the animal-black thus revivified is extremely variable; so that the problem, by which they demand the restoration of the black to its pristine qualities, after having been once used, is not yet completely solved.

gold; and then reduced into wire, by drawing it successively through a number of holes made in metallic plates, diminishing insensibly in a regular gradation.

The purity of the gold employed for this use is a point of the utmost consequence; for on this principally depends the beauty and durability of the colour of the laces, brocades, and other commodities prepared from it; and, unhappily, there is more room for abuse here, than in gold-leaf, the extension of the metal in this form, being less affected by an addition of alloy. The boasted superiority of the French laces to the generality of those made in England, for which various causes have been falsely assigned, appears to be wholly owing to a difference in the fineness of the gold: our workmen have, of late years, had finer gold put into their hands than formerly, and the produce has been judged not inferior to that of France; nor is it to be doubted, that the English artist, acknowledged not to be wanting in manual dexterity, will, with equal or superior materials, produce an equal or superior commodity. It should seem, therefore, necessary, for the purposes of so important a manufacture, where so much depends upon the purity of the gold, not only to employ it in the purest state to which it can be brought by the usual methods of refining, but even to seek for means of purifying it to a greater degree, than any of the common processes are capable of doing.

With regard to the silver, which makes the internal body of the wire, its fineness is of less importance. I have been informed, by some experienced workmen, that there is an advantage in its being alloyed; that fine silver, on being annealed in the fire, becomes so soft, as to suffer the golden coat, in some measure, to sink into it; and that the admixture of a little copper communicates a sufficient hardness, for preventing this inconvenience. Accordingly, the French silver for gilding is said to be alloyed with five or six penny-weight, and ours with twelve penny-weight, of copper, in the pound troy. Some have thought that this over-softening of the silver might be equally prevented, by using less heat; and that fine silver, receiving a smoother surface than such as is alloyed, must show the golden covering to better advantage. How far these presumptions are well founded; or how far the manufacture is affected, by the above differences in the quantity of alloy, I cannot take upon me to determine.

The gold is employed in thick leaves, prepared on purpose for this use, which are applied all over the silver rod, and pressed down smooth with a steel burnisher. Several of the gold leaves are laid over one another, according as the gilding is required more or less thick. The smallest proportion allowed by act of parliament is 100 grains of gold to a pound, or 5760 grains of silver. The largest proportion, for the best double-gilt wire, as Dr. Halley was informed by the workmen, is 120 grains to a pound; though I am told that, of late, the proportion of gold has been increased.

The first part of the drawing process, as well as the preparation and gilding of the silver rod, is performed by the refiner, who uses plates of hardened steel, with a piece of tough iron welded on the back, to prevent the steel from breaking. In this back part, the

holes are much wider than the corresponding ones in the steel, and of a conical shape; partly, that the rod may not be scratched against the outer edge, and partly for receiving some bees'-wax, which makes the rod pass more freely, and preserves the gold from being rubbed off. The plate being properly secured, one end of the rod, made somewhat smaller than the rest, is pushed through such a hole as will admit it, and laid hold of by strong pincers called clamps, whose chaps are toothed somewhat like a file, to keep the rod from slipping out, by the violence necessary for drawing it; the handles or branches of the clamps are bent upwards, and an oval iron loop put over the curvature; so that the force which pulls them horizontally by the loop, serves, at the same time, to press them together: to the loop is fastened a rope, whose further end goes round a capstan, or upright cylinder, with cross-bars, which requires the strength of several men to turn it. The rod, thus drawn through, is well annealed, then passed in the same manner through the next hole, and the annealing and drawing repeated; less and less force sufficing, as it diminishes in thickness; when reduced to about the size of a large quill, it is delivered in coils to the wire-drawer.

The remainder of the process requires plates of a different quality; those of steel, whether in a hard or a soft state, being now found to fret the wire, or to raise a bur upon its surface, and strip off the gold. The plates for this part of the work are brought from Lyons, in France: the holes are drilled in them here. They are formed of a metallic mass, whose composition is kept a secret, but whose prevailing ingredient is plainly iron. There are two sorts of these plates; one, of considerable thickness, for the wire in its larger state; the other, only about half as thick, for the finer wire, where less force is sufficient in the drawing. There are considerable differences, also, in the quality of the metal itself, not to be distinguished by the eye, or any otherwise than by repeated trials: such of the thicker plates as are found good are valued at a high price. The Lyons plates, though brittle, have sufficient toughness to admit of the holes being beaten up, or contracted, by a few blows of a hammer; so that when any of them have been widened, by a length of wire being drawn through, they are thus reduced again to the proper dimensions for preserving the gradation: the holes, after each beating up, are opened by a long slender instrument called a *point*, made of refined steel; one end of which, to the length of about five inches, is square, and serves as a handle; the rest, about twice as long, is round, and tapered to a fine point. The first holes, being soonest gulled, or so far worn as to be unfit for bearing further reductions, the next to them, grown likewise wider, supply their places, and are themselves successively supplied by those which follow; whence, as each plate is furnished with several more of the small holes than are wanted at first, it continues to afford a complete series after a considerable number of the larger have become unserviceable. Great part of the dexterity of the workman consists in adapting the hole to the wire, that the wire may not pass so easily as not to receive sufficient extension, nor so difficultly, as to be broken in the drawing.

For determining this point with greater certainty than could be done from the mere resistance of the wire, he uses a brass plate, called *a size*, on which is measured, by means of notches, like steps, cut at one end, the increase which a certain length of wire should gain, in passing through a fresh hole; if the wire is found to stretch too much or too little, the hole is widened or contracted. As the extension is adjusted by this instrument, there are others for measuring the degree of fineness of the wire itself: slits of different widths, made in thick polished steel rings, serve as gauges for this use.

The wire-drawer's process begins with annealing the large wire received from the refiner: this is performed by placing it coiled up on some lighted charcoal, in a cylindrical cavity, called *the pit*, made for this purpose, under a chimney, about six inches deep, and throwing more burning charcoal over it; the pit having no aperture at bottom to admit the air, the fuel burns languidly, affording only sufficient heat to make the metal red-hot, without endangering its melting. Being then quenched in water, for the sake of expedition in cooling it, though the metal would, doubtless, be softened more effectually if suffered to cool leisurely, one end of it is passed through the first hole in the thick plate, and fastened to an upright wooden cylinder six or eight inches in diameter: in the top of the cylinder are fixed two staples; and through these is passed the long arm of the handle, by which the cylinder is turned on its axis by several men. In the continuation of this part of the process, called *degrossing*, the wire is frequently annealed and quenched, after every hole, or every other hole, till it is brought to about the size of the small end of a tobacco-pipe: and in this state it is cut into portions for the fine wire-drawer.

In this last part of the wire-drawing process, annealing is not needful; but it is still necessary, as before, to wax the wire afresh at every hole. Much less force being now sufficient for drawing it through the plate, a different instrument is used: a kind of wheel, or circular piece of wood, much wider than the foregoing cylinder, is placed horizontally: in its upper surface, are some small holes, at different distances from the axis; and into one or another of these, according to the force required, is occasionally inserted the point of an upright handle, whose upper end is received in a hole, made in a cross-bar above. From this, the wire is wound off upon a smaller cylinder, called a *rotchett*, placed on the spindle of a spinning-wheel; and this last cylinder being fixed on its axis, behind the plate, the wire is again drawn through upon the first; and being at length brought to the proper fineness, it is annealed, to fit it for the flatting-mill. This annealing is performed in a different manner from the foregoing ones, and with much less heat; for if the wire was now made red hot, it would wholly lose its golden colour, and become black, bluish, or white, as I have often experienced, in different parcels of gilt wire. Being wound upon a large hollow copper bobbin, the bobbin is set upright, some lighted charcoal, or small coal, placed around it, and brought gradually nearer and nearer, and some more small-coal put into the cavity of the bobbin; the wire being carefully watched, that,

as soon as it appears of the proper colour, it may be immediately removed from the heat. This is an operation of great nicety, and is generally performed by the master himself. The wire, though it in good measure retains the springiness which it had acquired in the drawing, and does not prove near so soft as it might be made by a greater heat, is, nevertheless, found to be sufficiently so, for yielding with ease, to the flatting-mill.

The flatting-mill consists of two rolls, turned in a lathe to perfect roundness, exquisitely polished, placed with their axes parallel, one over the other; set by screws, till their circumferences come almost into contact, and both made to go round by one handle: the lowermost is about ten inches in diameter; the upper, commonly little more than two, though some make it considerably larger; and indeed it would be more convenient, if made as large, or nearly so, as the lower: their width or thickness is about an inch and a quarter. The wire, unwinding from a bobbin, and passing first between the leaves of an old book, pressed by a small weight, which keeps it somewhat tight; and then through a narrow slit, in an upright piece of wood, called *a ketch*, which gives notice of any knot or doubling; is directed, by means of a small conical hole, in a piece of iron, called *a guide*, to any particular part of the width of the rolls; that, if there should be any imperfection or inequality of the surface, the wire may be kept from those parts; and that, when one part is soiled, by the passage of a length of wire, the wire may be shifted, till the whole width of the rolls is soiled, so as to require being cleaned and polished anew, with the fine powder called putty, prepared by calcining a mixture of lead and tin: the workmen value the rolls, from the number of threads they will receive, that is, from the number of places, which the wire can thus be shifted to: good rolls will receive forty threads. The wire flatted between the rolls, is wound again, as it comes through, on a bobbin, which is turned by a wheel fixed on the axis of one of the rolls; and so proportioned that the motion of the bobbin just keeps pace with that of the rolls.

[*To be continued.*]

On the Italian Wire-drawing Plates; and on Welding Cast-iron to Wrought-iron, by H. W. Reveley, Esq. *Civil Engineer; with additional observations, by* Thomas Gill, Esq.

In the preceding article, "On preparing and gilding silver wire," extracted from the late Dr. Lewis's celebrated "*Commercium Philosophico Technicum*," the author mentions, that the gilt copper rods are first drawn through holes made "in plates of *hardened steel*, with a piece of tough iron welded on their backs, to prevent the plates from breaking;" and are finished by drawing them through smaller holes, made "in plates of a different quality; those of *steel*, whether in a hard or soft state, being now found to fret the wire, or to raise a bur upon its surface, and strip off the gold. The plates for this

part of the work are brought from Lyons, in France; the holes are drilled in them here. They are formed of a *metallic mass*, whose composition is kept a secret, but whose prevailing ingredient is plainly *iron*."

We have recently been favoured by Mr. H. W. Reveley with an account of the method practised in Italy for making their plates, and which is as follows:

A piece of plate-iron is formed into a sort of shallow box or tray, its edges being bent or turned up at a right angle all round. This case is then filled with broken pieces of *cast-iron*, and heated to a welding-heat, when it is well hammered, and firmly united to the iron. The holes are then punched through it from the back, the face of it being thus formed in the *cast-iron*.

This information throws considerable light on the probable method of forming the Lyons' plates; and, indeed, we know, that during the late war, *considerable quantities of cast-iron draw-plates were made and sold in this country for Lyons' plates, and fully answered their purpose!*

Mr. Reveley informs us, that the Italian and the Lyons' wire-drawers are continually in the habit of associating together. They gave the singular name of *Acciajo Salvatico*, or *Wild Steel*, to this compound of cast and wrought-iron.

It is not the first time that we have known of this union of cast with wrought-iron, by welding. In the North of England, many years ago, it was no uncommon practice to *steel*, as they termed it, horse-shoes with pieces of cast-iron at their toes and heels, with bits of broken cast-iron plates, generally the backs of stoves or grates broken to pieces, and afterwards to harden them like steel; and they were found to wear as well, whilst the cost was much less, than if steel had been actually employed.

The working of this cast-iron and wrought-iron in Italy is always done in *charcoal fires*, which it is essential to notice.

[*Tech. Rep.*

Improvement in Drawing Iron and Steel Wire.

Accident is frequently the source of improvement in the arts, and this valuable improvement owes its origin to this cause.

The acid liquor used in pickling iron-wire during the drawing of it, requiring to be warmed, ingots of brass, lying at hand, were accordingly heated red-hot and quenched in the liquor; the consequence of this was, that a portion of the copper in the brass became dissolved in the liquor, and was precipitated upon the surface of the iron-wire pickled in it.

It was found that *the wire thus coated passed through the holes in the plates with remarkable facility*, it requiring to be annealed much less frequently than before, owing, no doubt, to the copper prevent-

ing the action of the plate upon it, so as to gall or fret it, and, in fact, *lubricating* it as it were.

We need hardly add, that this circumstance happening in the manufactory of a scientific individual, he has since constantly availed himself of the use of a weak solution of copper in iron and steel wire-drawing. The slight coat of copper is entirely got rid of in the last annealing process. [*Ib.*

Directions for bending, blowing, and cutting of Glass, for chemical and other purposes. Extracted from Chemical Manipulation. *By* MICHAEL FARADAY, F. R. S.

1. THE art of blowing, bending, and cutting glass, is one of essential importance to the experimental chemist; but its use is not confined to him alone, there being many purposes in the arts, and in domestic economy, to which a knowledge of it is applicable. As an object of curiosity there are few things which are more attractive to persons in general, than the working in glass by the aid of the blowpipe; and although the first attempts may be unsuccessful, the Editor knows, from his own experience, that a moderate degree of skill may be obtained by a little perseverance.

Mr. Faraday, who, in his 'Chemical Manipulation,' has furnished the student with that practical and minute information, which is obtained only by the labour of years, has devoted many pages of his work to the art in question, the whole of which we shall publish in successive numbers, commencing with

The Table Blow-pipe.

This consists of a small table, furnished beneath with a pair of double bellows, worked by the foot. A tube is connected with them, which, rising through the table, is made adjustable above by sliding or moving joints, and terminates in a jet. This jet is of course larger than that of the mouth blow-pipe, being intended to urge a stronger flame, but still it should be smooth and well formed, and its aperture round and symmetrical. It is almost always the work of the instrument maker, but when a temporary jet is required, it may be obtained, excellent of its kind, by drawing out a piece of narrow thick green glass tube in the manner before described. The lamp (always sold with the table, though separate from it) should have a burner competent to hold a bundle of twisted cotton half an inch thick and an inch wide, the top of the burner being about two or three inches from the table, that the jet may easily be adjusted to any required position. Oil is the most convenient fuel for it, tallow or dripping, perhaps, the most powerful.

After having trimmed the lamp, leaving the cotton in a compact wick, rising about one-third or half an inch above the burner, light it, and place it on the table before the jet; then sitting on a chair with one foot on the treadle, work the bellows slightly, and

arrange the jet by moving the joints of the tube, until, being horizontal, or nearly so, its extremity is a little above the cotton, and close upon, or just within, the edge of the flame. The force of the blast should be such as to gather the flame, and make it proceed in the same direction with the jet without any upward inflection of its extremity. If, for want of power in the jet of air, this be not at first attained, it should not be effected by working the foot so rapidly as to fill the bellows and drive the air out by the direct force exerted upon the treadle; but the upper board of the bellows should have weights placed upon it in such quantity as to cause pressure sufficient upon the air within, to make it flow out with the required velocity. From the natural rigidity and tension of the leather, the pressure upon the included air will be greater when the bellows is nearly filled than when almost empty, so that the force of the blast may be varied by keeping the bellows more or less full, without any alteration in the loading weight. When an impulse is required stronger than that which can be produced by the weight and tendency of the bellows to collapse, more or less force may be superadded from the foot by means of the treadle.

The pencil need not necessarily include the whole of the flame rising from the wick, but as the remaining part throws off much smoke and fuliginous matter, it is better to conduct these substances away by a small hood and chimney. Such an arrangement has also the advantage of shading the bright part of the flame from the eye, in consequence of which the progress of operations carried on in the pale part are much more readily observed. It frequently happens when the flame of the lamp is too large for the jet, that no attempts to force the whole into a clear steady cone, will succeed; but upon advancing the jet a little way into the flame, the part beyond it will be thrown forward in the greatest perfection; whilst that behind the aperture rises upright in its usual state, and almost undisturbed. It is even generally advantageous to have this superabundance of flame. The pencil of flame should be conical and steady, not ragged or broken, but ending in a blue point, passing into a pale phosphorescent halo, without any luminous or smoky part at the termination.

Bending, blowing, and cutting of glass.

2. The methods of working glass by means of the table blow-pipe, will be first described, and afterwards the best mode of supplying its deficiency, by means of the common spirit-lamp and mouth blow-pipe. The chemist's operations are generally confined to glass in the form of tube, or rod; but though thus limited, they are daily useful, and it is only by practice and the frequent performance of such manipulatory processes as those described in Section xvi. that any adequate idea of their great value and service can be obtained.

3. Supposing the operator sitting before the table, the lamp trimmed and burning, the bellows put in action by the foot, and the flame clear, pointed, and steady; it will be desirable in the first place, to consider the particular circumstances requiring his attention whilst raising the middle or the end of a piece of glass tube to a red

heat, and also whilst cooling it to its first temperature. This is the simplest case requiring instruction, and must be performed with facility and readiness, before any further steps may be taken. If the tube is to be heated in the middle, its ends may be held by the fingers of each hand, so that the hands shall be beneath them, with the palms upwards; and the arms may be rested (till by practice they have acquired steadiness) upon the edge of the table. The part to be heated is to be brought, not into the flame, but into the current of hot air which passes off in the same direction from it, and the tube is to be turned, so as to become heated all round, and also moved a little to the right and left, that the temperature of the neighbouring parts may be raised. After a few seconds, when the glass has become hot, it should be brought towards the point of the flame, and ultimately into it, being turned round all the time, and also moved laterally, though not to the same extent as before, that the heat may be generally applied. By the time that the tube (supposed to be about half an inch in diameter, and one-tenth of an inch in thickness) is within the flame, occupying a place about midway between the commencement and the end of the nearly transparent part, it should be of a bright red or yellow heat, to the width of half an inch all round, so as to be perfectly soft at that part; and the heat should gradually diminish from it on each side, towards those parts which are still but little above common temperatures.

4. The tube is brought at first into the heated air, and not into the flame, because the hasty application of heat endangers fracture. Glass suddenly heated breaks, because a part is rendered hot directly in the neighbourhood of a cold part, and expanding, tears the cold and unexpanded part asunder. But when the heat is gradually applied, it has time to diffuse itself over the neighbouring parts, so that no contiguous portions have such differences of temperature as to occasion differences of expansion greater than the glass can allow, without separation of continuity. Hence the reason why the heat is directed to be applied gradually; and hence, also, the reason why the parts near to the particular spot requiring to be heated, are also purposely raised in temperature.

5. Thin glass, being heated through more rapidly than thick, requires less precaution than the latter; sometimes but little previous warming will be necessary for it, and on other occasions it may be brought directly into the flame. Some tubes are so small and thin that it will be found impossible to break them by the most sudden application of the flame; whilst with large and thick tubes it will be found almost equally impossible to heat them without making them fly to pieces. The precaution adopted must be in proportion to the size and thickness of the tube, and by a little practice will soon be duly appreciated.

6. When the end of the tube is to be heated instead of the middle, more care is required, in consequence of the great facility with which cracks commence at a sharp edge. A heat which would cause no danger if applied to the middle of a tube, would instantly cause the extremity to fly to pieces. In such cases it is best to begin by

warming the tube an inch, or a little more, from the end, and from thence proceed slowly to the end; always keeping the temperature of the part first heated rather higher than that of the end, until the glass softens, which will be below a visible red heat in daylight; after that, the end is safe, and the highest heat may be applied there.

7. The glass must not be blackened or discoloured during the operation of heating. This is a fault that may happen from either of two circumstances, namely, the incorporation of charcoal with the glass, or the reduction of the oxide of lead in it. When glass below a red heat is brought into the bright part of the flame,* a coat of charcoal is deposited; which in many cases does not disappear as the heat rises above redness, because of the incorporation of the charcoal with the melted glass; and occasionally it even increases in quantity. Being thus brought into contact with the oxide of lead in the glass, that substance is decomposed by the carbonaceous matter, and the lead being reduced, forms another kind of stain, which mingles with the former. When the stain happens by accident, it is removed by bringing the glass to the apex of the flame, that the oxygen of the air may act upon it; and if the discolouration be superficial, it is soon reduced and disappears. But this process is often inconvenient, because during the time the charcoal is burning away, and the lead becoming oxidized, the glass, which is necessarily in a melted state, is gathering together and thickening, or is contracting into inconvenient forms.

8. If after the glass has been raised to a full heat without any stain, it be brought into the bright, or especially the smoky, part of the flame, a part of the oxide of lead is reduced, and a stain occasioned. This should be immediately rectified, and removed as before, but it is far better that it should be altogether avoided.

9. The heat produced should not be irregular or patchy, varying with every turn or motion of the glass, but uniform all round a certain length of the tube: the greater the length which by the turning and lateral motions of the tube can be thus retained at a fair uniform red heat, the greater and more efficient is the skill of the operator. To this end it will occasionally be found advantageous to incline the tube to the direction of the flame, and not to hold it directly across.

10. After having proceeded thus far successfully, the operator should vary the temperature, and obtain the power of governing it; sometimes retaining the tube at a low red-heat by carrying it out of the flame; or raising it to as high a temperature as possible, by bringing it into the flame; or by confining the greatest heat to a narrow ring, or extending it as before mentioned over a broad one.

11. By this kind of practice, a knowledge of the heating power of different parts of the flame will be acquired. It will be found greatest within the pale flame just before the point of the bright flame, and that part will also heat the greatest quantity of matter. Its power

* The brightness of the flame *depends* upon the presence of particles of charcoal ignited in it. See Sir H. Davy on flame, Quarterly Journal of Science, ii. 124.

will diminish towards the extremity, though it will still be very considerable and capable of heating a large tube. The current of air which issues from, and may be considered as a prolongation of the flame, should also be properly appreciated. It has the power of keeping glass at a visible red heat at the distance of two or three inches from the point of the flame, and is of constant use in annealing tube and tube-apparatus, both in raising and lowering its temperature.

12. Besides this examination of the flame in the direction of its length, it should also be investigated laterally, as regards the power it possesses over a piece of tube, placed directly across and through it, compared with that which it exerts when the tube is a little above or below the axis of the cone. In this manner every variation produced by approaching the glass in different directions to the hottest part of the flame, may be ascertained and fixed in the mind. The glass worker, instead of varying the temperature of his source of heat, varies the position of his material in relation to it, and thus gains command of all temperatures, up to the highest which the flame can produce. The more perfectly he knows the necessary position, and the more readily he applies his knowledge and attains the temperature required, the quicker and the better will his operations be performed.

13. Besides the difference of heat dependent upon the different parts of the flame in which the glass is placed, much depends upon the size and thickness of the tube itself. It must be a powerful flame, and well managed, that will fully heat an inch in length of the middle of a glass tube, two-thirds of an inch in diameter, and the eighth, or more, of an inch in thickness. But a tube half an inch in diameter is easily heated; and when thin, or with one of smaller size, care is actually required that it be not brought into the most powerful part of the flame, and become so overheated and soft, as to be unmanageable. Practice alone affords a perfect acquaintance with these points: the size and thickness of tube, the state of the flame itself, and its power in different parts, varying almost infinitely.

14. The softness of the glass depends upon the temperature to which it is subjected. It begins to soften and bend below a visible red heat, and when in small portions is easily brought to a semi-fluid state. The condition of the glass is judged of as much by the fingers as the eye; the feeling which it has in the hands of bending with greater or less facility, or of giving way more or less readily as the ends are pushed or pulled, is a better criterion as to the proper moment of working it, than the appearance. Glass, being a transparent substance, does not assume such striking appearances, when ignited to different degrees, as opaque bodies; and its visible red heat is far higher than the visible red heat of metal or charcoal. Hence it is, that, if the glass has become stained as above described (7,) those parts will appear red-hot long before the glass. Notwithstanding these circumstances, glass when highly heated becomes visibly ignited, and these appearances help, together with the feel, to indicate its state. When of moderate thickness, the glass, in consequence of

the oxide of lead that is in it, assumes a greenish yellow tinge when it is heated; this occurs before a red heat, and helps, with other circumstances, to indicate its state. The experimenter should make himself well acquainted with these indicative appearances.

15. When the tube is in a thoroughly heated state, the experimenter should bend it; draw it out so as to render it thinner; and press it up again to increase its thickness. Stopping one end with his finger, and applying his mouth to the other, he should also blow it out and expand it; and by introducing a smooth piece of thick iron wire into a tube heated at the end, he should observe in what manner it gives way to the pressure, and to what extent it may be moulded. He will find that the glass may be bent as soon as it yields in the hands; that it must be much hotter before it can be properly drawn out or pressed up again and thickened; and that generally, the heat must be still higher for blowing and moulding. These comparative but necessary degrees of softness should be observed and remembered, as also the variations necessary for tubes of different thicknesses; thin tube, works, generally, at lower temperatures than that which is thick.

16. The experimenter should also acquire that steadiness, yet lightness of hand, and that power of retaining the tube between the fingers, which is necessary to prevent the distortion of soft glass. When heating a tube in the middle, it is impossible, whilst all is hard, not to hold it in a straight position, and any slight irregular strain or pull does no harm. But when the heat has brought the glass into a soft state, it is by no means easy so exactly to turn the tube at both ends alike, and so lightly yet equally to hold them, that the soft part shall retain its cylindrical shape; being neither twisted, nor bent, nor elongated, nor thrust up. Again, when the end of a tube is heated for an inch or more at once, or when a tube is heated so near the end that it cannot be supported there, but must be sustained from the other end, then the soft glass will tend by its weight to bend downwards. This must be counteracted by turning round the tube in the hand, so as continually to correct the inclination; letting the weight of the soft part at one moment rectify the bend it had received the instant before. During this practice it should rather be held with the hot end inclining upwards than downwards, the latter position having the apparent effect of tending to draw the soft piece of glass, as it were, from the remainder.

In these kind of practices is included that of retaining the glass steadily in one particular part of the flame at pleasure, and not moving it by uncertain motions of the hand from place to place. Very little experience will give a moderate degree of facility in these operations, and will enable a student to make his apparatus in a form adapted for use. Every fresh trial will increase his facility of working, and render his results more perfect.

17. Work of this kind should generally be performed at, or towards the lower surface of the flame, and almost always be removed out of the flame downwards. By this arrangement the hottest part of the glass is constantly at, or towards, the top of the tube, so that it may be seen; and consequently the operations, whatever they may be, as

sealing apertures, or fastening in platina wire, are more conveniently watched. The position of the hottest part of the tube being also constant, and known, allows of an advantage in bending or forming the glass; the force necessary, being applied in the proper direction, with certainty and readiness.

18. When the glass has received the required form, it is to be cooled; this must be effected with some care. It must never be taken directly from the flame and laid on cold bodies, as it is then almost sure to crack. When thin, it is not necessary to pay much attention to the annealing, but being brought to the end of the flame or beyond it, and there allowed to fall below a red heat, it may afterwards be laid aside on a tray or across some raised body, as a fragment of tube, that the hot part may be in the air. But if the glass be large or thick, it then requires annealing; for which purpose it should be carried slowly from the hot to the cooler parts of the flame, the appearances and tints being watched, that the temperature may be very gradually lowered; and it should be kept for several minutes in the stream of hot air beyond the flame for the same purpose, being gradually carried to the less heated part of it, and ultimately entirely removed. When laid aside it is adviseable to cover the cooling glass with a fold or two of paper or cloth, to make the loss of temperature still more gradual. These precautions are the more necessary if the glass varies in thickness, as for example, at the junction of one tube with another, or at the end of a tube sealed hermetically; and they are equally indispensable with the irregularities resulting from the awkward form of a bend, the fusion of wires into glass, or other circumstances.

19. The applications of these general directions will be best understood by describing some of the more directly useful operations. One of the simplest of these is that of forming the termination of a piece of glass rod to fit it for use as a stirrer. The piece of which it is to be formed is to be cut of a proper length. For this purpose a deep mark is to be made round the rod with the edge of a sharp three-square file, and being then grasped by the two hands placed one on each side of the mark, force is to be applied in a manner similar to that which is adopted in breaking a stick in two, except that in addition the hands are to pull slightly in opposite directions. If the separation be not readily effected, the file-mark must be deepened. Tubes are cut in a similar manner; such as are small, without difficulty or accident; larger ones with a little more care.

20. When separated by the file, the end of the rod is flat and the edges are sharp. Being heated carefully (5,) because of its thickness, beginning at a little distance from the extremity, it will be found that as soon as the glass has attained a visible heat at the end, the sharp angle at the edge will disappear, yielding to the cohesive force of the particles of glass, which will cause the end to assume a form more or less approaching to roundness. This effect being attained, the rod is to be annealed for a short time, cooled carefully, and is then ready for use. If a conical termination be required, then, when the end of the rod is hot and soft, the extremity of a fragment of glass

tube should be heated and pressed against it, and will adhere. The rod should then be moved a little, so that the greatest heat may be given at a tenth or twelfth of an inch from the end, and then by withdrawing the fragment, which serves as a handle, the end of the rod will be drawn away with it, leaving the termination of a conical form. When this is obtained, the tail of glass may be separated from what is to be the blunt apex of the cone, by bringing the point of the flame upon it, which causes the thin thread to fuse, separate, and run together. By retaining the end of the rod in the hot flame, the extremity will become more and more rounded; but when the desired form is acquired, the temperature must be lowered and the glass cooled as before described.

[TO BE CONTINUED.]

Prognostics of the Weather.

[Abridged from FORSTER's *Encyclopædia of Natural Phenomena.**]

Aches and Pains in the body of various kinds frequently forbode rain. Persons, for example, subject to rheumatism, feel more pain in the affected limb or part of the body before a change of weather, particularly when fair is to be exchanged for wet. Old carious teeth are also troublesome; and pains in the face, ears, and gums, are sometimes experienced. Limbs once broken also ache at the place of their union, and various other aches and pains too various and trifling to be specified, have been, from time immemorial, found to be signs of changes of the weather.

Animals, by some peculiar sensibility to electrical, or other atmospheric influence, often indicate changes of the weather by their peculiar motions and habits.

Ants.—A universal bustle and activity observed in ant-hills may be generally regarded as a sign of rain. The ants frequently appear all in motion together, and carry their eggs about from place to place.

Asses.—When asses bray more than ordinary, particularly if they shake their ears as if uneasy, it is said to predict rain, and particularly showers. I have noticed that, in showery weather, a donkey confined in a yard near the house, has brayed before every shower, and generally some minutes before the rain has fallen, as if some electrical influence, produced by the concentrating power of the approaching rain-cloud, caused a tickling in the windpipe of the animal, just before the shower came up. Whatever this electric state of the

* The writer of these Prognostics, has distinguished himself by his researches on atmospheric phenomena, a subject upon which we are, it is believed, more profoundly ignorant than upon any other which has received equal attention. The scraps which are here collected and detailed, by a gentleman of science, may be adduced as a proof of the truth of this opinion. It will be seen that many of them apply particularly to Great Britain, whilst the greater number are more general. They are presented less for their utility, than as a proof of the extent, or rather of the meagreness of our information upon the subject. EDITOR

air preceding a shower may be, it seems to be the same that causes in other animals some peculiar sensations, which makes the peacock squall, the pintado call "comeback," and which creates a variety of prognosticative motions in the different species of the animal kingdom.

Bats flitting about late in the evening in spring and autumn, at which seasons they are most commonly seen, foretell a fine day on the morrow, as do dorbeetles, and some other insects. On the contrary, when bats return soon to their hiding places, and send forth loud cries, bad weather may be expected.

Barometer.—A separate article upon this instrument will hereafter be given.

Balloons have been made use of to ascertain the direction of upper currents of air; and as their currents by degrees get lower, and support the current blowing near the earth's surface, we may often, by means of small air-balloons, foretell what will be the direction of the breeze at the next change of wind.

Berries in the hedges often forebode a hard winter, and severe weather frequently occurs in seasons when they are particularly plentiful on the Maybush and Blackthorn. This rule is not, however, without its exceptions.

Beetles flying about late in an evening often foretell a fine day on the morrow.

Blue sky.—When there is a piece of blue sky seen in a rainy day big enough, as the proverb says, "to make a Dutchman a pair of breeches," we shall probably have a fine afternoon.

Bones which have once been broken, and are re-united, are apt to ache before rain at the place of their re-union. See *Aches and Pains.*

Butterflies, when they appear early, are sometimes forerunners of fine weather. The first sort which appears in spring is the sulphur butterfly, *Papilio sulphurea præcox*, whose wings are of a pale greenish yellow. These come in March if the weather be fine and warm. The next sort are the tortoiseshell butterflies, early in April. And in May comes the common white or cabbage butterflies. Moths and sphinxes are also signs of fine weather, when they are common in an evening.

Calm.—A dead calm often precedes a violent gale; and sometimes the calmest and clearest mornings, in certain seasons, are followed by a blowing showery day. Calms are forerunners of the hurricanes of the West Indies and other tropical climes.

Candles, as well as lamps, often afford good prognostics of weather. When the flames of candles flare and snap, or burn with an unsteady or dim light, rain, and frequently wind also, are found to follow. The excresences from the wicks, called funguses, also denote rain and wind. The curious forms assumed by the excrescent wicks of candles has led to many superstitions.

Cats are said, when they wash their faces, or when they seem sleepy and dull, to foretell rain. The same is said of them when they appear irritable and restless, and play with their tails.

Cattle, when they gambol about in their pastures more than ordinary, foreshow rain, and in general a change of weather.

Chickens, when they pick up small stones and pebbles, and are more noisy than usual, afford, according to Aratus, a sign of rain.

Cherryclacks offer admonitions of the existence and nature of the gales and breezes by night. In the cherry season of July, the noise of these scare-birds is often troublesome. There is no doubt that a whistler, to scream by the wind, might be so constructed as to point out the fluctuating strength of the blowing gale.

Chilliness, and a sensation of cold greater than the indication of temperature by the thermometer, leads us to expect, often forebodes rain, as it shows that there is already an increased moisture in the air, which experience has shown to be referrible to its decomposition and the first formation of cloud.

Cirrostratus, or wanecloud, whenever it prevails, usually forebodes rain, snow, or hail; but there are, nevertheless, some nice distinctions to be made, and which a discriminating meteorologist may soon learn to make.

Cirrocumulus, or Sondercloud, is a congeries of small roundish little clouds in close horizontal apposition. The cirrocumulus is not always uniform in its appearance; it varies in the size and rotundity of its constituent nubiculæ, and in their closer or more distant arrangement. It is frequent in summer, and often forms very beautiful skies; at all times of the year it may be seen, in the intervals of showers, and before an increase of temperature, of which its prevalence is a pretty certain prognostic. Before thunderstorms a very dense sphere of this cloud may be noticed, whose nubiculæ are close, compact, and very round, and indicate a high electrical change.

Cirrus, or Curlcloud.—When, after much fine weather, this cloud first appears like a white line pencilled along on the azure sky, we may generally reckon on a change; and if the cloud increases, and others are added to it laterally, or if it change to the wanecloud, rain will probably follow before long. The tufts of cirrus, called mares' tails, are known to be a sign of wind, which has frequently been found to blow from the quarter to which these curlclouds have previously pointed.

Clouds of any sort, when they increase much, portend rain, particularly at eventide; when they are very red they often foreshow wind; when they form a dappled gray sky, with north wind, fair weather; when they rapidly form and evaporate, variable weather. Clouds fretted and spotted, covering the sky after fine weather, or wavy like the undulation of the sea, forebode rain.—See *Stratus*, *Cirrus*, &c.

Colours of various kinds in the sky and clouds, are tokens severally of different phenomena. Much red always forebodes wind and rain, particularly in the morning; in the evening it sometimes indicates a fine day, particularly if the morning be gray. A greenish colour of the sky near to the horizon, often shows that we may expect more wet weather. The most beautiful and varied tints are seen in autumn, and in that season the purple of the falling haze is often

a sign of a continuation of fine weather. When the clouds become more coloured than ordinary, and particularly when red prevails, it sometimes indicates an east wind.

Cold and Heat.—The coldest weather, on an average, happens in the middle of January, and the hottest in the middle of July.

The nearer approach of small birds to the windows of our habitations usually forebodes cold weather.

Cocks, when they crow at unwonted hours, often foretell a change of weather. We have often noticed this before rain. But this is by no means so certain a sign as many others, because at particular seasons, and in particular kinds of weather, cocks habitually crow all day. During the calm, still, dry, dark, and warm weather sometimes occurring in the winter months, and which may be called the halcyon days of our climate, cocks keep a constant crowing all night and day. There appear to be three principal cock-crowings in ordinary weather, namely, about midnight or soon after, about three in the morning, and at daybreak; the latter is never omitted. We have noticed, however, that when cocks crow all day, in summer particularly, a change to rain has frequently followed.* Cocks are said to clap their wings in an unusual manner before rain, and hens to rub in the dust and seem very uneasy.

Coronas round the sun or moon portend rain. Coloured crowns of light, and compounded halos, are more sure signs of a fall. See *Halo*.

Cream and Milk, when they turn sour in the night, often indicate thereby that thunderstorms are about, and will probably shortly take place. The effect is referrible to the electricity of the air at the time.

Cranes.—The high flight of cranes in silence indicates fine weather.

Crows utter a peculiar cry before rain, different from their usual voice.

Currents of Air change their course frequently in the higher regions of the air first, and are afterwards continued to the earth's surface; hence we can often foresee a change of the wind by observing the way in which the clouds above move. Both the strength of a coming gale, and the point of the compass from which it will blow, may usually be foreseen some time beforehand by noticing the velocity and direction of the clouds floating along in the upper currents, or by means of balloons.

Cumulus, or Stackencloud, is that large and irregular hemispherical kind of cloud which, in fair weather, usually forms in the day and subsides in the evening. These clouds, when they are very irregular in their shapes, when they are full of protuberances and fleeces, or when their fleeces curl inwards as they pass along in the wind, indicate rainy or showery weather. Their increase, instead of vanishing, at eventide, also portends the same thing, as does their change into twainclouds.

Cumulostratus, or twaincloud, compared with cumulus, which it

* See *Perennial Calendar*; also *Researches about Atmospheric Phenomena*, by T. Forster.

resembles, is more dense, and overhangs its base in uneven or rugged folds; a pre-existing cirrus, cirrocumulus, or cirrostratus, or one perhaps immediately formed for the occasion, alights on its summit, and inosculates. Many of these cirrostrati are sometimes seen attached to the cumulostratus, and sometimes to intersect it. Cumulostrati frequently remain in this state for a long time, and constitute very picturesque skies. At other times the processes are more rapid. The cirri, or cirrostrati, are soon lost in the cumulostratus, which increases in density, and soon becomes the nimbus described in its proper place. See *Nimbus*.

The cumulostratus is one of the stages in the process by which rain is ultimately effected, of which it may therefore be regarded as a prognostic. In Switzerland, Wales, Spain, and other mountainous countries, it may be confounded at a distance, in its early stages, with distant mountains.

Dead Nettles afford a sign of a mild season when they come in winter in abundance.

Dolphins, as well as *Porpoises*, when they come about a ship, and sport and gambol on the surface of the water, betoken a storm; hence they are regarded as unlucky omens for sailors.

Dogs, before rain, grow sleepy and dull, and lay drowsily before the fire, and are not easily aroused. They also often eat grass, which indicates that their stomachs, like ours, are apt to be disturbed before change of weather. It is also said to be a sign of change of weather when dogs howl and bark much in the night; they certainly do this much at the full moon, which has given rise to the saying relative to the *Dogs that bay at the moon*. Dogs also dig in the earth with their feet before rain, and often make deep holes in the ground.

Dreams of a hurrying and frightful nature, also incubus, and other symptoms of oppressed and imperfect sleep, are frequent indications that the weather is changed or about to change. Many persons experience these nocturnal symptoms on a change of wind, particularly when it becomes east. In all these cases the effect seems to be produced immediately on the nervous system, and through it on the stomach, so that the stomach shall again re-act on the sensorium. The symptoms are enhanced by a full stomach and other sources of indigestion. See *Wind*, also *East Wind*.

Drains and sespools smell stronger than usual before rain.

Drowsiness and heavy sleep, both in men and animals, often forebodes a heavy fall of rain or snow.

Ducks.—The loud and clamorous quackling of ducks, geese, and other water-fowl, is a sign of rain. It is also a sign of rain when they wash themselves, and flutter about in the water more than usual. The above prognostics apply to various other species of water-birds.

Ears, when there is a tingling noise, or what is called a singing in them, afford thereby a sign of a change of weather, not simply of rain, as has been said, but of barometrical pressure in general. The sudden increase of pressure, like the descent from high mountains, or from balloons, causes in many persons a temporary deafness and

roaring in the ears. A sudden fall of the barometer affects also the ears, but in a different manner, like mounting a high hill.

East Wind is frequently made known to nervous people in the night by imperfect sleep, headache, and hurrying dreams. It is remarkable that good astronomical observations cannot be made when the wind is east. And frequently, when the celestial objects seem to wave and move about in the field of the telescope, an east wind is found to follow, for it has already begun above in the higher regions of the air.

Eclipse Weather is a popular term in the south of England for the weather following an eclipse of the sun or moon, and it is vulgarly esteemed tempestuous, and not to be depended upon by the husbandman.

Epidemics are disorders of health brought on by atmospherical influence; and modern discoveries have shown how much most prevailing diseases partake of an epidemical nature. Scarlet fever, typhus, the plague, and indeed most diseases of this sort, are now considered epidemical. It would, perhaps, be productive of useful results, if physicians of extensive practice would make accurate meteorological registers during the prevalence of any epidemic or contagious disorders: such as the influenza, which, a few years ago, took a range of some miles round London, but was also prevalent in other parts of the country.

Epizootie is a name for epidemic disorders occurring among animals, of which we have many and various instances on record. The state of the electrometer and other atmospherical instruments, should be carefully examined during the prevalence of such pestilences.

Feathers, pieces of flue, or dry leaves, playing about on the surface of ponds and other waters, as if agitated by light and varying eddies of wind, often forebode rain.

Fieldfares, when they arrive early, and in great abundance, in autumn, foreshow a hard winter, which has probably set in, in the regions from which they have come. They usually come in November.

Fishes, when they bite more readily, and gambol near the surface of the streams or ponds, foreshow rain.

Fire.—The brightness and heat of the fire in winter often indicates frost and clear weather, as does the lodgment of the moisture on the windows; for it demonstrates a cold atmosphere abroad. When the fire burns dull, damp weather and non-electric rain often follow: it is said that the air on these occasions has less of oxygen. The real cause, however, is unknown.

Flowers are many of them excellent indicators of the approaching weather by their opening and shutting, and other motions. See *Pimpernel*, &c.

Fleeces, and Mares' Tails, as they are called, seen in the sky, are signs of rain and wind. By fleeces are meant those clouds which look like fleeces of wool. Mares' Tails are the comoid curl-clouds called Cirri: their prevalence forebodes wind. They look sometimes like distended locks of hair.

Flies, and various sorts of volatile insects, become more troublesome, and sting and bite more than usual before, as well as in the intervals of rainy weather, particularly in autumn, when they are very numerous, and often become a great nuisance. This observation applies to several sorts of flies. The horse-flies likewise, of all sorts, are more troublesome before the fall of rain, and particularly when the weather is warm.

Forests.—The hollow sound of forests, while the wind is roaring among the woods, is a sign of rain and of storms.

Frogs, by their clamorous croaking, indicate rainy weather; as does likewise their coming abroad in great numbers of an evening; but this last sign applies more obviously to toads. Abundance of yellow frogs are accounted a good sign in a hayfield, probably as indicating fine weather.

Fungi.—In the damp weather of autumn the fungus tribe become very numerous, and often are the first phenomena which remind us of the decline of summer, and the approach of a cooler season.

Gales of Wind are foretold by a sudden fall of the mercury in the barometer, or the appearance of wane-clouds and of curl-clouds, and by many of the signs of rain. Varying gales and changing breezes often indicate a change of weather from fair to wet. The most tremendous gales and storms have been foretold by the settling of the stormy petrels under the wake of a ship.

Gallinaceous Poultry in general appear uneasy, and rub in the dust, before rain.

Geese washing, or taking wing with a clamorous noise, and flying to the water, portend rain. When wild geese are observed to migrate to the southward or westward in greater numbers than usual in autumn or winter, they are said to indicate hard weather: and in general the early appearance of flocks of these and other wild fowls in the south, foreshow a severe winter.

Gnats afford several indications. When they fly in a vortex in the beams of the setting sun, they forebode fair weather: when they frisk about more widely in the open air at eventide, they foreshow heat; and when they assemble under trees, and bite more than usual, they indicate rain.

Gossamer, as it is called, being the fine web of a certain species of spiders, floating in the air in abundance, and lodging on the trees, or the rigging of ships, and on other objects, affords a sign of fine settled weather in autumn, as does the much covering of the ground and herbage by the woof of the spiders in general. See *Spider.*

Hail, Snow, and Sleet, have but few appropriate signs. In general, the clouds which are destined to pour the cool hail-showers of a March or April day, have more defined edges and a different sort of appearance from those clouds which eventually lead to rain. There is also a peculiar dark brownish purple colour in some of the large twain-clouds which precede the vernal showers of snow and hail.

Halo.—When this phenomenon is observed round the sun or moon, it indicates the presence of the wane-cloud, and shows that hail, snow, or rain, according to the season, will soon follow. Coloured or dou-

ble haloes are still more certain indications of rain, and often of wind also. When mock suns or mock moons, bands of light, and other unusual phenomena attend haloes, a peculiar condition of the atmosphere is indicated. The proper *halo*, or luminous ring, is distinguished from the *corona* or luminous disk, which is sometimes a forerunner of rain also, but is a thing of more frequent occurrence. When haloes are very red, wind almost always follows.

Headaches often foretell a change of weather in persons subject to such complaints. There is also some obscure change of weather near to the periods of new and full moon, which causes a certain ephemeral headache, that begins usually in the morning, gets worse about two o'clock, and subsides in the evening, attended with an irritated stomach; it much resembles the ordinary bilious headache from repletion, but differs from that which follows immediately on a certain sort of indigestion. Indeed, most periodical disorders seem to be connected with some atmospheric changes. And it is very remarkable, that they should so often have their worst paroxysms, and the crisis of their terms, about the time of the conjunction and the opposition of the moon.

Hogs, when they shake the stalks of grain and spoil them, often indicate rain; also when they rub in the dust, the same or some similar phenomenon may be expected. When they run squeaking about, and throw up their heads with a peculiar jerk, windy weather is about to commence: hence the Wiltshire proverb, that "pigs can see the wind."

Horses, as well as some other domestic animals, foretell the coming of rain by starting more than ordinary, and appearing in other respects restless and uneasy on the road. It has been questioned whether those animals do not manifest also some periodical irritability, like that which influences mankind. Possibly the eyes of certain horses, like those of certain persons, may be attended with *muscæ volitantes*, or other imperfections of sight, which render their perceptions of objects less perfect before rain; they may also become more generally irritable. The fact, however, has frequently come under our observation.

Hydrometers are intended to indicate when the air is moist, or dry; and hence become prognostics of rain, which often follows a general dampness of the air.

Incubus, or nightmare, though it commonly comes of a loaded stomach, will, nevertheless, often occur on the occasion of a change of weather in the night, which seems to produce the effect by disturbing the digestive organs. The same observation holds good with regard to those frightful and impressive dreams which some persons have in particular kinds of weather, and about the period of change. An east wind beginning to blow in the night will often cause them; and sometimes the same effect is produced by that state of the atmosphere which immediately precedes a large fall of snow; though the latter phenomenon more often produces dulness and languor of the whole animal system of the body.

Jackdaws are said to be more than usually clamorous before rain. These birds frequent the flocks of rooks, and with them go out to feed, as if they were aware of the superior sagacity of the rook in finding out the most productive pasture, and had learnt to avail themselves of it. Starlings sometimes do the same. Sometimes before a change of weather, the daws make a great noise in the chimneys wherein they build, and the sound coming down the flue is distinctly heard in the chamber.

Kites.—The birds so called, *Falcones Milvi*, soaring very high in the air, denote fair weather, according to many authors. The same is observed of ravens—*Corvi Coraces.*

[TO BE CONTINUED.]

FRANKLIN INSTITUTE.

The eighteenth Quarterly Report of the Board of Managers of the Franklin Institute.

The Board of Managers of the Franklin Institute, present to the General Meeting, the eighteenth Quarterly Report of their transactions during the term which has elapsed. No subject of immediate or peculiar interest has occupied the attention of the Board since their last report; the concerns of the institution have been duly administered, and are believed to be in as prosperous and flourishing a condition as at any period since the organization of the society. The Board are enabled at this time to state, that the Actuary has entered upon the discharge of the various duties devolving upon him, and from his exertions the Board anticipate the most beneficial results. Since the last quarterly report, the committee of premiums have published their list of premiums to be awarded to competitors at the annual exhibition in October next, together with an address to the manufacturers of the United States. These have been extensively circulated, and it is confidently expected will produce the effect contemplated. The importance and value of the annual exhibitions of the Institute, to the mechanics and manufacturers of the United States, and to the interests of the Institute, is no longer doubtful, the success of former years abundantly verifies and establishes the fact, and encourages us to hope that the exhibition in October, 1828, will be equal in all respects to those of former years. The Board, therefore, call with confidence upon the members of the Institute, to aid them in carrying into effect an object of such vital importance to the interests of the institution, and of such manifest utility to the mechanics and manufacturers of the union. The subject of the location of the High School, has occupied the attention of the Board, and is now referred to the committee of instruction. The Board, therefore, deem it inexpedient at present, to make any report upon a subject, on which there exists a diversity of opinion, more especially as it is a subject of deep interest, not only to the Institute, but to the community at large.

The High School under the control of its present able and efficient Principal, Mr. W. R. Johnson, has been gradually rising to such a state of improvement, as is calculated to elevate the standard of classical learning in our community.

The Franklin Journal, under the new arrangement, has been regularly and punctually issued, and its general concerns promptly and faithfully attended to by the Actuary of the Institute, under the direction and supervision of the committee of publication. The Board are happy to announce that since it has been published under the auspices of the Institute, there has been a considerable increase of subscribers, and that it may be considered in a prosperous condition.

The Board regret to state that there exists a great degree of negligence on the part of the members, in the payment of their annual contributions; they hope the mere mention of the evil will be sufficient to remedy it. All which is respectfully submitted by

SAMUEL J. ROBBINS, *Chairman.*

On the Combination of a Practical with a Liberal course of Education. By W. R. JOHNSON, *Principal of the High School of the Franklin Institute.*

No. II.

THE *principles* which ought to serve as the basis of a practical, republican system of education, combining useful with liberal pursuits, have already been stated. Before proceeding to give an account of the school in the establishment and management of which these principles have been *exemplified*, it may not be improper briefly to exhibit the views and purposes of the institution, of which this school is a department.

The society bearing the name of the "Franklin Institute," was established "for the purpose of promoting the mechanic arts, and of improving the *condition*, *character*, and *prospects* of the industrious class of society by whom they are exercised."

The first attempt to establish a society for this purpose was made in November, 1822, but without success. In December, 1823, a meeting of a few gentlemen was held, and in February, 1824, a *public* meeting was called for the same object. At the *latter*, the constitution was adopted. The first step taken by the society, towards accomplishing its purposes, was the establishment of lectures. These were commenced in April, subsequent to the organization of the society, were miscellaneous in their subjects, and were, at first, voluntary and gratuitous. During the winter of 1824, regular professors of natural philosophy, of chemistry, and of architecture, delivered courses of lectures on their respective subjects. A school for drawing, and another for mathematics, were opened for two quarters during the same season. In November, 1825, the means of instruction were still further increased, by the addition of a course of lectures on natural history.

Such were the advantages for instruction afforded by the Franklin Institute, previously to the 1st of January, 1826, at which time the Franklin Journal was established. The value of this vehicle of information to the adult mechanic, is sufficiently obvious, and the extensive circulation which it has attained, evinces that its importance is felt and acknowledged. So far as the instruction of *men* was to be effected, the Institute had not left scarcely any thing to be desired; but the "*condition, character*, and *prospects*" of the industrious classes of society, must be still far from enviable, if they were left without the means of accomplishing what is dearest to every intelligent parent's heart, the early and thorough education of their children. This end can be but partially and imperfectly attained by lectures. The latter may, in certain branches, be rendered highly useful as *subsidiaries*, but as *substitutes* for lessons, for study, recitations, examinations, and that system of responsibilities by which the talents of the teacher are made to act on the mind of the pupil, they are nearly powerless. Aware of this fact, and sensible of the paramount importance of youthful education, some of the leading members of the Institute early expressed a desire, that a school should be established for imparting instruction in the various branches of an elementary and useful education. The execution of this design was unavoidably delayed longer than that of the other plans of instruction, partly by the want of proper accommodations, and partly by the necessity of more maturely digesting the details of the system. On the completion of the Society's Hall in the summer of 1826, the former of these obstacles was removed, and the timely exertions of the committee of instruction, surmounted the latter. A few hundred dollars were collected by subscription, to provide the necessary furniture, and the school went into operation on the 4th of September, 1826.

It may be proper here to remark, that in addition to its influence in improving the "condition and prospects" of the industrious classes of society, by its lectures, its Journal, and its schools, the Institute has, since 1824, held annual exhibitions of manufactures, to which the citizens of the United States have been invited to send the products of their skill and ingenuity, and have been severally rewarded according to the decision of able and impartial tribunals. All these objects have been prosecuted simultaneously, and without any improper interference of one with another. The mathematical school was the least numerously attended; and since the establishment of the High School, its purposes are so fully answered there, that its continuance has not been deemed necessary.

Though avowedly established for the promotion of certain interests, this society is by no means narrow and exclusive in its spirit. It does not consist entirely of mechanics. Many citizens in various walks of life, have enrolled themselves among its members, from a thorough conviction of its usefulness, and from a hearty concurrence in its design of promoting the diffusion of useful knowledge, and the advancement of the mechanic arts.

Among the subscribers to the Journal, and to the courses of lec-

tures, no less than on the registers of the schools, will be found the names of many of our most wealthy and respectable citizens. The large and liberal views of the philosopher whose name the society has adopted, are happily exemplified, both in the nature of its exertions, and in the spirit with which they are prosecuted. Franklin never forgot the intellectual and moral part of human nature, while pursuing those studies which pertain to the physical world. The friend, alike of learning, of liberty, and of the arts, he endeavoured to bring into harmonious intercourse the different orders of society, and he doubtless felt that the most effectual mode of attaining his purpose, was to unite their efforts during the period of early educacation. Hence his zeal in the cause of *public* institutions for education. Hence his donations for the bestowment of premiums on meritorious scholars; and hence his exertions for the formation of literary societies among the young, to facilitate the interchange of thought, and the early development of merit, in every rank.

Under those happy political institutions which Franklin and his compatriots have transmitted to the present generation, it is in vain to think of limiting the ambition of youth to those precise objects which their fathers have pursued. The vigorous mind and elastic spirits of the young *American*, are constantly prompting him to new enterprises, to fresh pursuits, and to higher objects of ambition. The character of the society is in accordance with this spirit of the American community.

It may readily be inferred from the slight sketch above given, of the Franklin Institute, how far its operations have tended to promote the true interests of society; and from the following delineation of the course of study pursued in the High School department, an opinion may be formed respecting its adaptation to advance the same interests, to forward the general purposes of the Institute, and to realize the wishes of Franklin, and other patrons of learning and the useful arts.

The annual payment of *three* dollars is the only pecuniary consideration required to constitute a member of the society, with the right of voting at elections, and of attending all its public lectures, and exhibitions of manufactures.

Apprentices and other lads are allowed to attend all the lectures of a season, by the payment of *one* dollar each. Tickets for ladies are issued at the price of *two* dollars each.

The annual subscription to the Journal is *five* dollars.

The fee for instruction in the drawing school is *four* dollars per quarter.

In the High School the price for all branches is *seven* dollars per quarter.

The above charges have hitherto been found adequate to obtain distinguished talents for the service of the society, and should the public continue duly to appreciate and reward the efforts which are here made to render knowledge accessible to all classes, little doubt can be entertained that the same talents may still be retained for similar purposes.

FIRST YEAR.

REMARKS.	DAILY EXERCISES.	WEEKLY EXERCISES.
FIRST QUARTER. The academical year commences on the first Monday in September, and continues twelve weeks. The second quarter commences immediately after the close of the first, and continues for the same length of time, and so on through the year.	1. Arithmetic. *Colburn's Sequel.* 2. Geography, with the use of Maps. *Worcester.* 3. Writing from dictation, defining the words, and analyzing the sentences written. *Murray's Grammar and Exercises. Walker's Dictionary.* 4. Greek Grammar and Delectus. *Valpy.* 5. Latin Grammar. *Adams, Gould's edition.* 6. French. *Porney's Syllabaire, and Perrin's Fables.* 7. Linear drawing. *Fowle.*	1. Elocution. *American First Class Book.* 2. Pronunciation of French. *Fables.* 3. Exercises in oral composition.
SECOND QUARTER. The hours of attendance are from 9 till 12, in winter, and from 8 till 11, in summer, for the forenoon; and from 2 till 5, in the afternoon. On Wednesdays and Saturdays but 4 hours are employed.	1. Arithmetic, (continued.) *Colburn.* 2. Geography, (continued.) *Worcester.* 3. Correction and analysis of sentences containing false syntax. *Murray's Exercises.* 4. Greek Grammar, and Greek Delectus, (continued.) 5. Latin Grammar, and *Jacobs'* Latin Reader. 6. French. *Wahnostrocht's Grammar. Fables.* 7. Drawing *mechanical implements* in outline.	1. Elocution, (continued.) *Class Book.* 2. French pronunciation. 3. Oral composition.
THIRD QUARTER. A semi-annual examination is held at the end of the second quarter. All scholars are required to attend the examinations.	1. Arithmetic, (continued.) 2. Geography, (continued.) 3. Exercises in correcting false punctuation. *Murray.* 4. Greek Reader. *Jacobs'* Grammar, (continued.) 5. Latin Reader and Grammar, (continued.) 6. Telemachus. *Bolmar's edition.* 7. Drawing, (continued.)	1. Elocution. *Class Book.* 2. Stenography. *Gould.* 3. Composition from memory, *descriptive pieces.* 4. French pronunciation.
FOURTH QUARTER. The year closes with the annual examination, about the first of August. During that month the school is closed, no charges are made, and no instruction is given. The other holidays are New Year's, 22nd of February, three days at Easter, 1st of May, 4th of July, and from Christmas till the Monday following.	1. Algebra. *Colburn.* 2. Ancient Geography. *Worcester's Atlas.* 3. English Prosody. Exercises in Poetry, written from dictation. *Milton.* 4. Greek Reader, (continued.) 5. Latin Reader, second part. *Jacobs.* 6. Telemachus, (continued.) French phrases. *Hentz.* 7. Spanish. *Jossé's Grammar.* 8. Drawing of Maps.	1. Elocution. *Class Book.* 2. Stenography. 3. Compositions, (continued,) *narrative pieces.* 4. Spanish pronunciation.

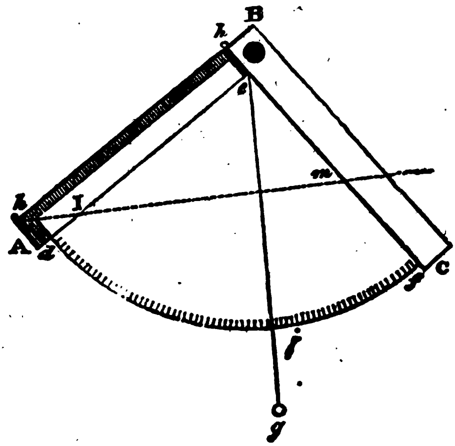
SECOND YEAR.

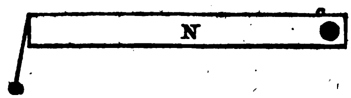
	DAILY EXERCISES.	WEEKLY EXERCISES.
FIRST QUARTER. **REMARKS.** No scholar is compelled to study all the branches assigned for any particular part of the course. Much less is he allowed, when his course has been selected, to make capricious changes.	1. Algebra, (continued.) *Colburn.* 2. Ancient Geography, (continued.) Use of globes. 3. Greek Reader, (continued.) 4. Latin Reader, second part, (continued.) *Jacobs.* 5. Telemachus. Written exercises in French. 6. Spanish. *Traductor Espanol.* Phrases. 7. German. *Shade's Grammar.* 8. Drawing. Elements of landscape.	1. Elocution. *Walker's Rhetorical Grammar.* 2. Natural Philosophy, illustrated by lectures and experiments. *Conversations, Jones' edition.* 3. Exercises in Greek. *Neilson.* 4. Composition, (continued.)
SECOND QUARTER. The exercises for Wednesdays and Saturdays are, in general, different from those of the other four days in the week, and are therefore classed under the head of *weekly exercises.*	1. Algebra, (continued.) 2. Use of globes, (continued.) 3. Greek Testament. (*Four gospels.*) 4. Latin Reader, (continued.) 5. Historical Reading, in French. *Peter the Great.* 6. Translations from Spanish, (continued,) and Spanish exercises. 7. German Reader. Grammar, (continued.) 8. Landscape drawing, (continued.)	1. Rhetorical Grammar, (continued.) 2. Natural Philosophy, (continued.) 3. Greek Exercises, (continued.) 4. Composition, with the study of its elementary principles. *Appendix to Murray's Grammar.*
THIRD QUARTER. The pupil, on entering the school, must have learned reading, writing, English Grammar, and the first rules of Arithmetic. A knowledge of Geography is also very desirable.	1. Geometry. *Legendre.* 2. Ancient History. *Worcester's Elements,* and charts. 3. Græca Majora, first volume. *Dalzel.* 4. Ovid. Latin Prosody. *Adams' Grammar.* 5. French, (continued.) 6. Spanish, (continued,) with written exercises. *Jossé* or *M'Henry.* 7. German, (continued. 8. Drawing, (continued.)	1. Mythology. *Tooke.* 2. Rhetorical Grammar, (continued.) 3. Natural Philosophy, (continued.) 4. Latin Exercises. *Dana's Latin Tutor.* 5. Compositions on themes selected.
FOURTH QUARTER. The text books of the school must be possessed by each scholar. The extent of the school, and the number of branches taught, render changes and varieties inadmissible.	1. Geometry, (continued.) 2. Ancient History, (continued.) Book-keeping, *Hitchcock.* 3. Græca Majora, (continued.) 4. Virgil. *Gould's edition.* 5. French poetry. 6. Spanish, (continued.) 7. German, (continued,) with written exercises. 8. Drawing from models.	1. Mythology, (continued.) 2. Rhetorical Grammar, (continued.) 3. Natural Philosophy, (continued.) 4. Latin Exercises, (continued.) 5. Composition.

THIRD YEAR.

	DAILY EXERCISES.	WEEKLY EXERCISES.
FIRST QUARTER. REMARKS. Before a scholar can be entitled to instruction in any branch, his fee for the quarter must be paid, for which a *receipt* is given, but no bills are sent out for collection.	1. Trigonometry, with application of Algebra to Geometry. 2. Modern History. *Worcester's Elements.* 3. Græca Majora, (continued.) 4. Virgil, (continued.) 5. Translations from English to French. 6. Double translations in English and Spanish. 7. German, (continued.) 8. Drawing from machinery. Laws of perspective.	1. Mythology, (continued.) 2. Rhetorical exercises. 3. Explanation of the structure and uses of machinery. 4. Latin Exercises. 5. Composition.
SECOND QUARTER. Each recitation occupies about *forty-five* minutes.	1. Surveying and Mensuration. 2. Modern History, (continued.) 3. Græca Majora, second volume. Greek Prosody. 4. Cicero's Select Orations. 5. Conversations in French and Spanish. 6. German, (continued.) 7. Drawing from subjects in Natural History.	1. Elocution, (continued.) 2. Chemistry, with lectures and experiments. 3. *Elegantiæ Latinæ.* 4. Composition.
THIRD QUARTER. The lectures on natural philosophy, chemistry, &c., pertaining to this course, are entirely distinct from the public lectures before the Institute, and are commonly given after the morning exercise on Wednesdays.	1. Astronomy. *Gummere.* 2. Political Economy. *Conversations.* 3. Sallust and Horace. 4. Græca Majora. Written translations from Greek. 5. Original compositions in French and Spanish. 6. Conversations in German. 7. Drawing, (continued.)	1. Rhetoric. 2. Chemistry, (continued.) 3. Elegantiæ Latinæ. 4. Composition.
FOURTH QUARTER. It is not expected that the whole of the above course can be completed in three years by any but scholars of the very best capacity, and most exemplary diligence. A few individuals now in the school are in a fair way to accomplish it.	1. Astronomy, (continued.) Calculation of Eclipses. 2. Constitution of the United States, and of the state of Pennsylvania. 3. Tacitus. 4. Græca Majora. Modern Greek. 5. French and Spanish composition, (continued.) 6. Natural History. 7. Architectural drawing.	1. Rhetoric. 2. Chemistry. 3. Elegantiæ Latinæ. 4. Composition.

A simple and easily constructed Instrument for observing the height of Objects, &c.





A B, B C, two equal pieces of wood turning on a screw at B, *e d f* a slip of parchment or paper pasted to the legs A B, B C, and folding between them when closed, after the similitude of a fan. Let the outer part *d j f* be made the quadrant of a circle to radius *e d*, and let it be divided into 90 degrees; *e j g* a plumb-line falling from the centre, and *h h*, two sights. If through *h h*, the top of any object be observed, the plumb-line *e j g* will cut off the number of degrees (*j f*) contained by the angle of elevation. The proof is very evident. Let *h I m* be the horizontal line, to which *e j g* will always fall perpendicular: and since *I e m* is a right angled triangle, $\triangle$ (Eucl. vi. 8) $\angle f c g = \angle e I m = \angle$ of elevation. The instrument may be closed as at N, and carried in the pocket. [*Register of Arts.*

Observations on the immediate effect of applying Oil to lessen friction in axle trees. By Mr. H. Palmer.

Mr. Henry Palmer, in his work upon rail-roads, makes the following observations upon a phenomenon which we believe had not been previously noticed; as it appears likely to suggest some valuable

ideas in the lubricating of delicate machinery, we have thought it worth insertion.

"During a succession of experiments, occasionally, for many months, I invariably perceived, that when fresh oil was applied to the axles of the carriage, *the resistance was increased*, and it required the ordinary motion of the carriage for several days to restore the resistance to its usual standard. No other presumption occurred to account for this fact, than the possibility of the oil being better adapted for its office after being some time exposed to use. It was suggested by a scientific acquaintance, that the oil became thickened, or less fluid, after exposure to the air, and was therefore better able to resist the contact of surfaces. In order to prove this, I thickened some oil artificially, by the admixture of a small quantity of bees' wax, but the appearances were the same as before. It then occurred to me that there was not sufficient play, or difference of diameters, between the axle and the nave in which it worked; I therefore had the axles slightly reduced. On again measuring the resistance, I found circumstances as before, but differing in amount, the resistance being slightly increased. I was by this time convinced that the quantity rather than quality of oil occasioned the appearances; to prove which the axles were made perfectly clean, and then simply moistened with oil by the finger previous to inserting them in the wheel. In this state the resistance was again measured, and found to be *similar to the standard usually observed* after the carriage had been some days in motion as before described. It being then proved that the *quantity* of oil occasioned the difference of resistance, the following solution of the manner in which the additional quantity could produce such an effect, appeared reasonable:—

Fig. 1.

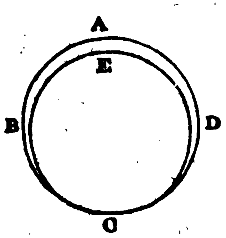
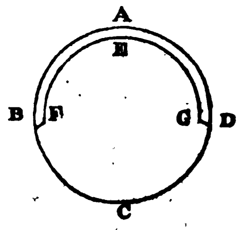


Fig. 2.



"Let A, B, C, D, Fig. 1, represent the circle of the hole in the nave of the wheel, and E, C, the section of the axle. The circle E, C, touches A, B, C, D, only in the point C. A very acute angular space then remains between A, E, and C, on either side of E, C. If that space be filled with oil, the oil may be considered as a wedge, and if the outer circle be set in motion, that wedge will endeavour to pass the point C: But it cannot pass in its present form without raising the circle E, C; but E, C, having the weight of the carriage upon it, would resist its passage.

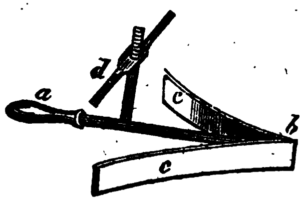
"Now this continual and unsuccessful endeavour to pass the point C, will occasion an impediment to the motion.

"To put this solution to the test, the axles were formed as in Figure 2. A, B, C, D, is the hole in the nave as before, and E, F, C, G, the section of the axle. The lower semicircle of the axle here corresponds with, or is parallel to the outer circle, but no farther, because, *if it corresponded throughout the circle, the axle would be liable to jamb, as other experiments have proved.* The coincidence then ceases abruptly, as at B, F, G, D; and the space above, which contains the oil, is not angular, but the quantity of oil which is to pass toward the lower semicircle is determined at B or D.

"On measuring the resistance with the axle thus formed, I found it not increased by any quantity of oil that might be inserted, but by dispensing with the angular space and consequent wedge-like action of the oil, *the resistance was one-tenth less than the former standard.* In cases where the difference of diameters is considerable, I do not apprehend the obstruction from the quantity of oil would be of consequence: but it is desirable to make the bearing surfaces nearly to correspond, to obtain a greater *width* of touching surface, and the more perfectly to govern the motion. The form of axle just described, is, in fact, the converse of a well made plummer block used in machinery." [*Ib.*

Description of an Expanding Wedge for Sawyers.

The Society of Arts has presented the "Silver Vulcan Medal" to Mr. T. Griffiths of the Royal Institution, for the invention of an expanding wedge, for the use of Sawyers, a representation of which we here annex.



a is the handle or centre piece, to which is connected two springs *c c*, joined together at *b*, the handle also carries a cross piece *d*.

This instrument is intended chiefly to save the *time* and *trouble* of shifting the common wedges, while sawing up logs of pine, &c. into boards. When the saw has cut two or three feet, the loose ends of the springs *c c* are to be brought, by hand, as near to the centre piece *a* as their elasticity will admit; the end *b* is then to be introduced into the cut, and the wedge is to be thrust up to the end of the spring, the cross piece *d* resting on the upper surface of the balk. The elasticity of the springs will then be continually opening the cut as the saw proceeds to the length of about twelve feet, and the wedge, when at its utmost expansion, will be prevented by the cross-piece from falling into the pit. It requires to be adjusted only once in twelve feet. [*Abridged from the Trans. Soc. of Arts.*

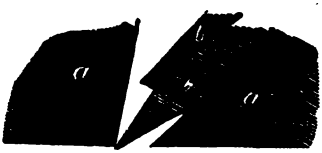
The "trouble" of pushing in the common wedges used by Sawyers is very little indeed; the "time" occupied is but a few seconds,

and at those periods when the men rest a minute or two from the laborious operation of sawing. We much doubt whether sawyers would use Mr. Griffith's expanding wedge, if given to them; and we are quite sure, that they would not, out of regard to the invention, make a cut twelve feet long through a thick piece of timber without stopping. It is difficult to conceive what must be the feelings of a member of the *Royal Institution*, when he receives an honorary medal from a scientific body, for such a common blacksmith's job. We are bold to say, that any man of ordinary capacity, with a taste for practical mechanics, would invent one hundred things, quite as important and valuable, every day for a month together, were the subjects proposed to him. [*Editor Journal Arts.*

Description of a Plane for Hard or Cross Grained Wood, for which a reward was given to the inventor by the Society of Arts.

The cutting edge of an ordinary plane-iron, has been hitherto uniformly produced by grinding, or otherwise forming a slope or bevil upon only one side of it; the blade being then fixed in the stock of the plane, in such a position as to form an angle of about 45 degrees with the lower surface, its operation upon the wood is partly of a *cutting*, and partly of a *scraping* nature. In planing some kinds of wood, great inconvenience was found from this form by its frequently tearing up the surface, instead of smoothing it; a partial remedy for this defect was in consequence introduced about 24 years ago, by which another plane-iron, called a *top*-iron, was added to the under one, by means of a strong connecting screw, which caused the top iron, particularly at the edge, to press closely upon the lower one, as shown by the annexed figure (which is an edge view of the lower ends of both,) *d* being the lower iron, and *e* the upper. The cutting edge of *d*, which projects a little beyond *e*, is therefore the same as before, but it is prevented from entering so deeply into the wood, or rather the shaving which has been abraded from the wood, receives a new direction by the abrupt interposition of the top iron *e*, and is thus prevented from causing a tearing up with the grain, to the destruction of a level surface. The advantage of the "double plane iron" over the "single plane iron" being, therefore, unquestionable, the latter are consequently almost disused; the remedy is, nevertheless, incomplete, inasmuch, as the lower iron presents the same angle as before; it cuts *better*, it is true, but recourse to the scraper is still necessary.

The improvement now introduced is the invention of an ingenious workman named Williamson. It consists simply in employing the *single iron* as previously used, which is to be made of cast steel, of greater thickness than usual, and to be *bevilled on both sides*, as represented in the annexed section of a portion of a plane. *a a*, is

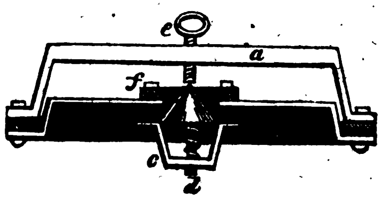


part of the body, *b* the wooden wedge, and *c* the plane-iron as fixed. By this form of edge, it will be perceived that it partakes more of the action of the *scraper*, and obviates more effectually the defects and objections to the former constructions. The edge is more strong and durable, it gives a beautifully smooth surface, almost without the aid of the scraper; and is considered to be peculiarly valuable in planing hard or coarse grained woods, and in cutting woods against the grain.

Remarks by the Editor.—The foregoing improvement, as it is denominated, has been rewarded, commended, and published in several scientific journals; yet, in despite of all this favourable testimony, we venture to assert, that the double bevil, upon which its merit appears to rest, is a point of no importance whatever, and that a common single bevilled iron, placed in the stock, so that its face should form the same angle with the face of the plane, which is formed by the cutting side in the drawing, would cut as steadily and smoothly, as if double bevilled. The irons of toothed planes for veneers, of planes for brass and copper, and for many other purposes, are generally denominated upright irons, by the workmen; not that their faces always form a right angle with the face of the plane, but because they are more upright than in ordinary planes, and they are so placed that they may operate as scrapers. All that can affect the cutting of a plane iron are its firmness, the angle its cutting edge forms with the face of the plane, and the angle of the cutting edge itself, and it is perfectly evident that these may be the same, whether the iron be ground in the ordinary way, or in the manner proposed by Mr. Williamson. The top iron the Editor can remember for 40 years past.

Description of a Safety Valve for Steam Boilers.

This valve is the contrivance of Mr. C. Sockl, who has been rewarded by the Society of Arts, with their large silver medal, and ten guineas, for the invention. It appears to be calculated to afford very great security, and, in the opinion of the inventor, is peculiarly applicable to steam boilers on board of vessels.



Instead of the solid lid which covers the main hole, a copper-plate or dish is to be substituted, as shown in the above figure. *b* is the

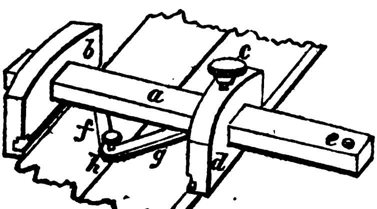
copper dish, surrounded by a ring of the same, by which the plate is firmly screwed down upon the rim of the main hole. In the middle of the plate is fixed the valve, of which *f* is the collar, made of iron or brass; *d* the plug, which is ground air-tight into the collar, and is kept in its place by the spiral spring which surrounds its stem, and the stay *e:* over the whole is fixed a strong cross piece *a*, which is firmly screwed down upon the ring that secures the plate *b*. In the cross piece works the regulating screw *e*, which may be screwed down upon the head of the plug.

The operation of the valve is easy to understand. *b*, the plate or dish, is only one-fourth or one-third the thickness of the other parts of the boiler; it will not afford the same resistance to the steam: when this, therefore, gets beyond the ordinary pressure, it will cause the plate to become somewhat convex, and will thus leave a clear space between the collar *f*, and the conical plug *d*, for the steam to escape; as soon as the power diminishes, the plate will, by its elasticity, return to its former place, and by closing down upon the plug, prevent any further escape of steam.

The object of this valve is not so much to regulate the working pressure of the steam, as to act in aid of the common valve, by affording an additional aperture in case the steam should acquire a dangerous degree of force. It differs from the plug valves in common use in this circumstance, namely, that in the latter, the plug rises out of its socket, in order to allow a vent for the steam; whereas, in Mr. Sockl's, the socket rises away from the plug: the chief advantage resulting from this is, that if any adhesion should have taken place between the plug and the socket, it is more likely to be overcome, on account of the great surface of the socket with its attached copperplate, which are exposed to the action of the steam.

Description of a Bisecting Gauge, invented by H. R. PALMER, *Civil Engineer.*

THIS contrivance is for the purpose of marking a line along the centre of any parallel or tapering solid, which, from its construction, it is evident, it will do with the greatest accuracy. It answers all the purposes of the common gauge, while it is peculiarly serviceable in other respects for which the common gauge is wholly inapplicable; in making mortices, and in enabling workmen to measure from a centre line, and to work with greater accuracy and facility, and in many other cases it would be found a very convenient instrument.



The annexed figure is a perspective view of the gauge. *a* is a square bar of hard wood, having two sliding cheeks, *b d*, fitted tightly to it. The cheek *b* is fixed fast on one end of the bar, whilst the other slides upon it, but may be made fast at any required place by the thumb-

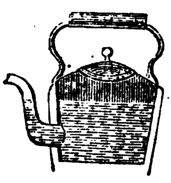
screw, *c*. At the end, *b*, a common scribing point is fixed in the bar, and with this and the sliding piece *d*, it forms the common gauge used for drawing parallel lines from the edge of any piece of wood work. The addition made by Mr. Palmer consists of two brass arms, *f* and *g*, of equal length, which are centred in the two sliding cheeks, at *a a:* the other ends are jointed together by the screw, *h*, which is formed into a sharp conical point beneath, to mark the work with.

In using this gauge it is evident that the point of the screw, *h*, will always keep in the centre between the two cheeks, *b d*. If the work is not parallel in its width, then the screw, *c*, must be loosened, and the two cheeks, *b d*, must be kept pressed towards each other so as to be in contact with the sides of the work; when the point *g* will traverse along the centre of the piece as correctly as if its sides were parallel; because in all situations it preserves an equal distance between the two cheeks, *b d*. These two cheeks have grooves made in them, to receive the brass arms, *f* and *g*, when the cheeks are brought into contact.

Remarks by the Editor.—A gauge similar in principle to that above described has been long in use, particularly for the purpose of gauging pillastres for the purpose of fluting them; it is usually made by taking three strips of wood, and joining them together with screws somewhat in the form of the letter H. The connecting piece is a little longer than the width of the pillastre at the widest part; each of the end pieces is allowed to swivel upon the screw by which it is attached to the connecting piece; this latter is laid off for the flutes and spaces, and into each division a pointed sprig is driven so as to form a marking gauge. By using the end pieces as guides, the pillastre will be gauged for fluting, and the diminution of the flutes will correspond with that of the pillastre.

Improvement in the Tea Kettle, and other vessels for culinary purposes.

A Mr. Gordon, of London, is manufacturing tea-kettles, and other culinary vessels, which are said to be very economical; the improvement consists simply in enclosing vessels of the ordinary kind, such as tea-kettles, stew-pans, &c., with an outer casing surrounding their sides, but open at the bottom, for the flame of a lamp to act upon it. When heat is applied to vessels so constructed, the plate of air between the cases becomes highly rarified, and the heat, having no tendency to descend, accumulates in the upper part to such an intense degree, as to be capable of melting a rod of glass if passed up the cavity.

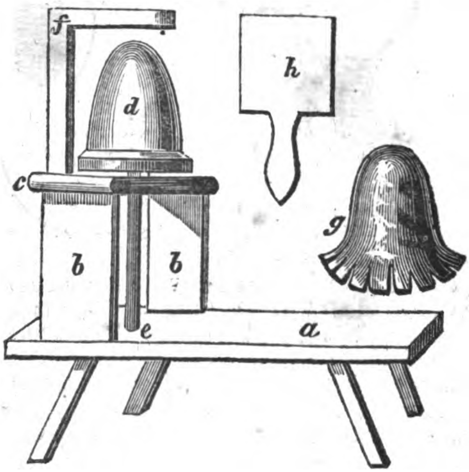


In vessels of the usual construction, the greater part of the heated air escapes without producing any useful effect; in these, however, it is detained, and the water may in consequence be boiled in a very short space of time. The chief advantages of the new construction are, therefore, economy of heat, or of the inflammable matter em-

ployed in producing it, economy of time, and convenience; the value of these may be variously estimated by different individuals, but all will acknowledge that they are important.

On improved Melting Pots, for Cast Iron and Brass.

In the 2nd vol. of this journal a description of Anstey's improved melting pots was given, and to this article we refer our readers. We have obtained an engraving of the apparatus used by Mr. Anstey in forming them, which we insert to render the article referred to, more clear and useful.

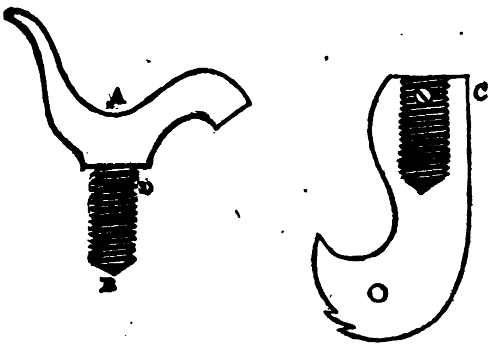


Every brass, or iron founder, must be fully sensible of the value and importance of melting pots, for the fusion of metals, that will remain unaltered after exposure to the intense heat of an air furnace. The composition employed in the manufacture by Mr. Anstey, consists of two parts of Stourbridge clay, and one part of the hardest coke, well ground and tempered together, according to the following recipe.

Take two parts of fine ground raw Stourbridge clay, and one part of the hardest gas coke, previously pulverized and sifted through a sieve of one-eighth of an inch mesh. Mix the ingredients together with the proper quantity of water, and tread the mass well, (if the coke is ground fine, the pots are very apt to crack.) The pot is moulded by hand on a wooden block, as shown in the engraved figure, in which *a* is the bench; *b b* two uprights, supporting a cross board *c*, and ends in a pin that turns in a hole in the bench; *f* is a gauge to regulate the thickness of the melting pot, as shown by the dotted lines; *g* is a cap of linen, or cotton, placed wet on the core before the clay is put on; its use is to prevent the pot from sticking partially

to the core while it is taking off; the cap adheres to the pot only while wet, and may be removed without trouble or hazard (to the pot) when dry: *h* is a wooden bat, to assist in moulding the pot; when moulded, they are carefully dried at a gentle heat.

Improved Fire Arms.



The following is a plan for discharging a double barrelled pocket pistol, on the percussion principle, with only one lock. It is quite as simple, and more certain, than the way in which it is effected with the flint lock.

The barrels are placed side by side, or they might with a little more workmanship, be placed one above the other, and each has its separate nipple. The cock will be better understood, by referring to the figure: the upper part of it A, is fixed to the lower part by the strong screw B, and a small pin or screw C is passed through them both, the hole D being wider than the pin, in order to admit of the top of the cock being turned a little one way or the other.

The pistol is kept with the cock turned either way; and on one barrel being fired, all that has to be done, is to cock the pistol again and turn the cock the other way as far as it will go, when it will be ready to strike the cap on the other barrel. [*Ib.*

Optical Amusements.

Gentlemen,—As I find that your object is to familiarize scientific truths, and, to use a homely phrase, make useful knowledge available to "the vulgar," I readily furnish my quota to so laudable an undertaking. As I have paid particular attention to optical science, with reference to the amusement to be derived from its pursuit, I cannot do better than commence my papers by furnishing a series of curious optical experiments, which may be performed without costly apparatus.

A curious optical deception may be thus produced. It is to exhibit an erect object, which, when placed near a hole in a card, will appear to be on the other side, and also inverted and magnified. Let a card be perforated with a small hole, and placed opposite a white wall or window, the eye of the observer being situated on the other side of the card. A pin being then placed between the eye and card will be seen on the other side of the aperture, inverted and magnified as already described. The reason of this is, as M. Le Cat has observed, that the eye, in this case, sees only the shadow of the pin on the retina, and since the light which is stopped by the upper part of the pin or its head, comes from the lower part of the white wall or window, whilst that which is stopped by the lower end of the pin comes from the upper part, the shadow must, necessarily, appear inverted with respect to the object. The accidental variations of the temperature of the air, at different depths, produce great irregularities in its refraction, especially near the horizon. The most remarkable of these is occasioned by the refraction of the air in the neighbourhood of the surface of water, of a building, or of the earth itself, in consequence of which a distant object appears to be depressed, instead of being elevated, and is sometimes seen at once both depressed and elevated, so as to appear double, one of the images being generally in an inverted position, as if the surface possessed a reflective power; and there seems indeed to be a considerable analogy between this kind of refraction and the total reflection which happens within a denser medium. These effects are known by the appellations, *looming*, *mirage*, and *Fata Morgana:* they may be very completely imitated, as Dr. Wollaston has shown, by looking at a distant object along a red-hot poker, or through a saline or saccharine solution with water, and spirit of wine floating on it. The effect of refraction on the apparent places of terrestrial objects must be frequently disturbed by circumstances of this kind; but its magnitude is usually about one tenth of the angular distance of the object, considered as a part of the earth's circumference.

The following experiment which illustrates, in a pleasing manner, the actual formation of haloes, has been given by Dr. Brewster. Take a saturated solution of alum, and having spread a few drops of it over a plate of glass, it will rapidly crystallize in small flat octohedrons, scarcely visible to the eye. When this plate is held between the observer and the sun, or a candle, with the eye very close to the smooth side of the glass-plate, there will be seen three beautiful haloes of light, at different distances from the luminous body. The innermost halo, which is the whitest, is formed by the images refracted by a pair of faces of the octohedral crystals, not much inclined to each other. The second halo, which is more beautifully coloured, with the blue rays outwards, is formed by a pair of faces more inclined; and the third, which is very large and highly coloured, is formed by a still more inclined pair of faces.

Each separate crystal forms three images of the luminous body, placed at points 120° distant from each other, in all the three haloes; and as the numerous small crystals have their refracting faces

turned in every possible direction, the whole circumference of the haloes will be completely filled up. The same effects may be obtained with other crystals, and when they have the property of double refraction, each halo will be either doubled, when the double refraction is considerable, or rendered broader, or otherwise modified in point of colour, when the double refraction is small. The effects may be curiously varied, by crystallizing, upon the same plate of glass, crystals of a decided colour; by which means we should have white, and coloured haloes, succeeding each other.

Yours, &c. OPTICUS.

[*London Journal.*

BURSTALL *and* HILL'S *Steam Carriage.*

THE patentees of the Edinburgh Steam Carriage, which has been mentioned several times in our preceding volumes, have brought to London a working model of their invention, for the purpose of demonstrating the practicability of running a steam coach upon ordinary roads. This model, which contains several improvements upon the former patent, is made upon a scale of three inches to the foot of the intended stage coach, which is, they say, in considerable forwardness.

As we have not yet reported the specification of the last improvements proposed in connexion with this invention, we shall not at present enter into a particular description of the model, but merely say that, in our opinion, the arrangements of the machinery do the patentees great credit; the model is neat and performs extremely well.

It is, however, to be remembered, this is but a model, and though the practicability of constructing a steam coach, that should be capable of travelling upon ordinary roads, may be demonstrated, (which we have never doubted,) yet it is by no means proved how far a sufficient speed can be obtained, or what economy may be derived in working a full sized stage coach by steam, instead of horses.

The model is constructed on a scale of 3 inches to the foot, is 5 feet six inches long, 16 inches over the wheels, and 1 foot 10 inches high, the middle or propelling wheels being 13 inches in diameter.

"The full size carriage is intended to be about one foot longer than a two horse stage coach and horses. Seven feet four inches high to the roof, the wheels being the common breadth apart. It will be retarded or stopped in running down hill by a powerful lever and friction-break, which acts on the two fore wheels, within reach of the conductor; at the same time, by a crank and rod, the throttle valve is closed, which shuts off the steam. The engineer behind can at pleasure stop the engine.

"The machine, with all its wheels smooth, and without either propellers, or any other adhesion on the ground, except the natural friction of the iron against the road, carries with ease and rapidity, up an ascent of one in eighteen, a weight equal to forty passengers upon a common stage coach, demonstrating that, on *this plan*, stage coaches

may be propelled with *safety, economy and speed*, not to be attained with horse coaches, and capable of making the present common roads of the country fully as economical as rail-roads, except in situations of extraordinary traffic.

"The boiler is so constructed as to be perfectly safe, and the most timid person may view the working of the model without either danger or annoyance." [*Ib.*

ENGLISH PATENTS.

Account of a Patent obtained by John Palmer de la Fons, *Dentist, and* William Littlewart, *Mathematical Instrument Maker, for their Invention of an Improvement in Securing or Mooring Ships, and other floating bodies, and Apparatus for performing the same.* Enrolled January, 1827.

Instead of securing ships and other vessels in harbours, rivers, and creeks, by means of anchors, or mooring blocks, as usual, the patentees propose to drive piles into the earth or sand in the bed of the harbour or river, from which piles, chains are to be carried to floating buoys, and to these the vessels are to be secured by mooring chains.

This mode of securing ships and other vessels by piles, instead of mooring blocks or anchors, constitutes the leading feature of the invention, and claim of patent right; but the manner of fixing these piles in the ground, below the water, is described in the specification, though not claimed.

A large conical rim of iron is provided, having a tube passing through it in the direction of an axis, which tube swings in jimbles, or a ball and socket, at the upper part of the conical rim, in order that the tube shall preserve a perpendicular position, however uneven may be the ground upon which the case of the conical rim may rest. Into this tube, the pile is introduced, and, with the conical rim, is let down to the bed of the harbour or river, by means of a crane or windlass, mounted upon a platform between two stationary vessels, placed over the spot where the pile is to be driven.

The conical rim now resting upon the ground, with the pile erect, its point downwards, a chain is attached to an iron ring in the top of the pile, which chain is affixed above to a pile driving apparatus of nearly the usual construction. The rammer or weight of the pile driver is now let fall, which sliding down the chain, strikes the head of the pile, and by repeated strokes, drives it into the earth.

When the pile has been driven sufficiently far into the ground, the conical rim is drawn up, and the vessels with the apparatus removed to another station, for the purpose of driving a second pile, and so on until the required number of piles are all fixed.

The series of piles are proposed to be placed in a circle or square range, in the centre of which the floating vessel is to be moored, by

means of ropes or cables extending from the vessel to the buoys and mooring chains of the several piles. In this way of mooring the vessels, the draft upon the piles will be seldom upwards, but principally in a lateral direction, which they will be able to resist, being firmly fixed in the ground. [*Ib.*

Account of a Patent obtained by John Lane Higgins, Esq., *for his Invention of certain Improvements in the construction of Cat-Blocks and Fish-Hooks, and in the application thereof.*—Enrolled January, 1827.

The apparatus which forms the subject of this patent is a pulley-block for taking hold of, or fishing an anchor, and for drawing it up, or catting it, in the act of weighing the anchor.

The patentee states, that the mode of catting an anchor according to the usual practice, is attended with so much labour and inconvenience, that in passing down a river, in order to save the trouble of hauling it in, the anchor is frequently left suspended from the vessel, below the surface of the water, which greatly impedes its progress.

Without describing the invention in the nautical terms which the specification sets forth, it will be sufficient to say, that the "*Fish-hook,*" or hook by which the ring at top of the anchor is taken hold of, when drawing it out of the water, has an eye or hole at the back, through which a rope is passed. By this hook, which is attached to the pulley or "*Cat-block,*" suspended from the cat-head, the anchor is drawn up, and held until it can be made fast on board the vessel. The rope from the eye at the back of the hook, being, at the same time, passed over the end of the cat-head, and secured.

Should it be necessary to let go the anchor suddenly, the tackle of the cat-block is to be relaxed, when the rope passed through the eye of the hook becoming tight, draws the hook back, and thereby allows the anchor to slip over the point of the hook, and descend through the water to the bottom. [*Ib.*

Account of a Patent obtained by William Hobson, *Gentleman, for his new Invented Improved Method of Paving Streets, Lanes, Roads, and Carriage Ways in general.*—Enrolled March, 1827.

The first and most essential matter in paving the highways of public streets and roads, where there is a very great traversing of heavy carriages, is to lay a solid and firm foundation previous to placing the paving stones. With this consideration in view, the patentee commences by spreading, evenly, the earth, rubbish, or any material of which the foundation of the road way is to be formed, and then ramming it hard, or rolling it, so as to produce a very sound and firm bed. He then proposes to break stones into small pieces, and spread them over the previously rammed earth, upon which broken stones,

forming a sort of M'Adamized foundation, the regularly cut paving stones are to be placed.

The intended forms of the paving stones are not specified; but it is to be presumed, that they are to be cubes, which being placed close together, and properly rammed, the interstices between the stones are to be filled up with a sort of cement or grout, made of sand, lime, and water, and which, when dry, will securely bind the stones together, and form them into one entire terrace.

The same method may be adopted when the road is formed of pebbles, (viz.) first ramming the foundation very hard, and then spreading the broken stones upon which the pebbles may be placed, and cemented together by pouring upon them grout or fluid containing such substances as will coagulate, and on drying, become a hard, adhesive substance, similar to stone. [*Ib.*

Account of a Patent obtained by JOHN GREGORY HANCOCK, *Plate Bender and Canister Hinge Manufacturer, for his Invention of a New Elastic Rod, for Umbrellas, and other like purposes.*—Enrolled January, 1827.

THESE elastic rods are made from ozier twigs, cut to any convenient length, and the pith removed from the internal part of the ozier twig by an ordinary boring tool. When this has been done, a rod of steel is introduced into the hollow part of the twig for the purpose of giving it stability.

The external part of the ozier twig may be now scraped or plained down, and finished by painting and varnishing, and ferrules or shoulders may be attached to the rod as may be required, for the purposes of sticks, whips, or the stems of umbrellas, or any other purpose to which these rods may be applicable.

The patentee claims to be the first inventor and maker of rods formed in this way. [*Ib.*

Account of a Patent obtained by ROBERT DICKENSON, *in consequence of a communication made to him by a certain Foreigner residing abroad, for an invention for the formation, coating and covering of Vessels or Packages, for containing, preserving, conveying, and transporting goods and products, whether in liquid or solid forms, and for other useful purposes.*—Enrolled June, 1827.

The subject of this patent divides itself into two parts: first, the formation of a metal barrel, cask, or other vessel of capacity, suited to the packing and conveyance of food and other perishable commodities, on ship-board, and in foreign climates; and, secondly, in a

mode of, and material for, coating the said metal barrels or casks, to prevent rust.

The patentee describes the new invented vessels to be barrels or casks, made of plate iron, in a cylindrical or a prismatic form, one end of which is secured by doubling the edges of the metal over, or by soldering them together, or by any other means that may be found convenient to render the joints air-tight; the other end, which may be called the top, has the edge of the iron plate turned inwards, for the purpose of forming a ledge to support the moveable end or lid, and a hoop of metal is rivetted or otherwise fastened round the interior of the vessel, near the top, standing up, and by that means producing a recess or groove, into which a gasket or elastic pad is to be placed, in order to render that joint air-tight when the lid is put on.

The gasket or pad is to be made by a ring of tin plate, or some such material, formed to the shape of the vessel, and then wound round with flannel or other flexible substance, and coated on the outside with oil-skin, or oiled silk, which being soft and elastic, will be easily pressed into the groove, and produce a perfectly air-tight joint when the lid is put on.

The lid being a circular plate, or of any other form suited to the shape of the vessel, is placed upon the gasket or pad, and several sliding bolts or latches attached to the outside of the lid, are then to be projected into corresponding holes or slots perforated through the upper part of the rim of the vessel, and the edges of which holes or slots are to be made inclined or bevelled, for the purpose of drawing the lid tight down upon the gasket, when the bolts are projected. Thus the vessel is headed or closed, and the goods within preserved from the action of the external air.

It is a very extraordinary circumstance, that the same construction of iron barrels, or casks for packing perishable goods, is described, as the subject of a previous patent granted to the said Robert Dickinson, in October, 1824. (See the 5th volume, page 369.)

The vessels, when constructed of sheet iron in the way above described, are to be tinned according to the ordinary process of tinning, and they are afterwards to be covered with an alloy or mixture of metals made in the following proportions:—

Take seventy-five pounds of tin in ingots, and having melted it in a furnace in the usual way, add to it twenty pounds of zinc; when these are properly melted together, then introduce five pounds of finely pulverized glass, and stir the whole until it is uniformly mixed together. These proportions are considered to be the most eligible, but a slight variation therefrom would be of but little consequence.

With this composition in a fluid state, the barrels or casks are to be coated in a similar way to tinning, and after that has been done, another coat of tin is put upon it, which completes the process, and protects the iron from the action of the atmosphere, and consequently precludes the possibility of its rusting.

In these vessels it is intended to pack flour, bread, biscuits, or any

other kind of provision, and to keep it secure from the atmosphere, and from vermin on shipboard, and elsewhere. The same kind of vessels are likewise suited to hold a great variety of other perishable articles, and to preserve them from injury in a very superior way to any other kind of packing. [*Ib.*

Account of a Patent obtained by VALENTINE BARTHOLOMEW, *Gentleman, for his Invention of Improvements in Shades for Lamps, and other Lights.*—Enrolled February, 1827.

THE patentee proposes to construct a lanthern of an octagon or any other eligible form, with ornamental framework, and panels of painted glass, or other transparent medium, which lanthern is to be put over the lighted lamp, and the subjects contained in the transparent panels by that means are illuminated. The frame-work of the lanthern is made to imitate a gothic building, the transparent panels representing windows.

Over the burner of the lamp, which may be of gas, or oil, of the Argand, or any other construction, an arched wire is carried, having a point at top to support and suspend the lanthern, and the aperture in the upper part of the lanthern for ventilation, is covered by a fan, in the centre of which there is a small hollow, intended to bear upon the central point when the lanthern is placed over the lamp, and equally poised.

The heat of the lamp rising to the top of the lanthern, creates a current of air, which in its passage through the fan, turns the fan and the lanthern slowly round, upon the centre or supporting point, and thus by the rotation of the lanthern, the transparent subjects are successively brought into the view of a spectator.

We are not aware what particular feature of novelty appertains to this invention, nor what the patentee intends to claim as his invention, as lantherns with transparent painting have been in use for ages, and are commonly called Chinese lantherns. As to the rotatory motion produced by the heated air passing from the burner through the fan at top, that is a simple philosophical experiment which we have known for many years applied exactly in the same way.—[*Ib.*

AMERICAN PATENTS.

Specification of a patent for an improved mode of fixing the Mariner's Compass. Granted to LEMUEL LANGLEY. Dated May, 1828.

To all to whom these presents shall come, be it known, that I Lemuel Langley, of the town of Norfolk, in the state of Virginia, have invented an improvement in the mode of fixing the Mariner's Compass, which is described in the words following; to wit,

The object of my said improvement is to dispense altogether with the binnacle, in which the compass is ordinarily fixed, to cause it to answer all the purposes of a 'tell tale,' and to secure it against accident from cannon shot, the shipping of heavy seas, or other causes of injury. The mode in which these ends are attained, is by cutting a hole through the deck of the vessel, at or near the place where the binnacle is usually situated; this hole is cut through into the cabin, and within it is placed the compass with its box, suspended in the usual way, and when so situated it is completely out of the reach of cannon or other shot. In order to cause it to act as a *tell tale*, the compass box is made with a glass bottom, so that the card can be seen as perfectly in the cabin, as upon deck; I also make the compass card translucent, or semi-transparent, in consequence of which it may always be lighted from below, and will be much more plainly seen at night, than when lighted in the ordinary way. The compass is defended at top by a very thick piece of glass; such as I have used has been three-fourths of an inch in thickness, and this is also defended by a rim, or band projecting above the deck; the lower side of the box is also glazed; and I contemplate sometimes making the sides of the box of glass, should it be desirable to admit light in that way.

What I claim as new in the above described invention, is the fixing of the compass entirely within the planking of the deck of a vessel; and the mode of rendering it equally visible, both upon deck, and in the cabin.

LEMUEL LANGLEY.

Remarks by the Editor.—We have seen but few things better calculated to answer the intended purpose than the foregoing invention. Whilst the deck of the vessel remains, the mariner's only guide, the compass, is perfectly secure. The small projection which it has been thought best to give to the glazed rim, may be completely protected from cannon shot, by a wide plate of iron fixed around it, so as to rise a trifle higher than the rim, whilst its edges are level with the deck. A British vessel was in the port of Norfolk when Mr. Langley was fixing one of his compasses on board a United States vessel, the captain of which preferred it very much to the costly binnacle and tell tale with which his own ship was furnished; there is but little doubt, therefore, that we shall soon see the invention patented in England, as it is not there required that the patentee should be the inventor. Mr. Langley, we believe, has not taken any measures to secure it for himself in that country. We frequently recognise the improvements made by our countrymen, in the accounts of English patents; of this we have no right or inclination to complain, but we cannot help feeling that justice requires that the credit of having made useful inventions, or discoveries, ought to be given to the country to which they belong; the situation of the Editor will enable him hereafter to attain

this end in almost every instance, and his inclinations will lead him to give it the required attention.

Patent granted to James P. Allaire, *for a "Steam Chimney or Receiver."* Dated May 14th, 1828.

The improvement is an application of the heat, that usually passes up the chimney and is lost, in such a manner, to the steam after it is generated, as to rarify, or still further expand it. It consists of a steam chimney or receiver, so constructed that the steam generated in the boiler must, when used, pass over, or by the heated metal of the fire chimney, in such quantities only as is necessary to supply the engine.

The space from the external part of the steam chimney or receiver, to the external part of the fire chimney being small, each renewed supply of steam passing through the steam chimney or receiver, is brought in contact with the heated metal of the fire chimney, which imparts the extra heat in the metal to the steam, thereby keeping the temperature of the steam used, nearly up to that of the metal of the fire chimney, and also preserving the metal from oxidation or burning.

As the improvement consists in passing the steam over, or in contact with the heated metal to promote expansion, without exposing it to oxidation, the fire may be applied outside of the steam as well as inside, by having the conductor of the steam of a suitable size, and surrounded by fire.

It may be used for distilling, heating rooms, &c.

James P. Allaire.

Remarks by the Editor.—The foregoing specification appears to us to be less definite than such an instrument ought to be, as it does not particularize any arrangement by which the intended effect is to be produced; from the words of the patent law, and from the nature of the thing to be done, this would appear to be necessary to a good description. Flues have been repeatedly passed through the steam in the upper part of a boiler, for the purpose of giving to it a higher degree of elasticity, and thereby avoiding, in some degree, the waste of that heat which passes up the fire chimney. The advantages expected from this mode of procedure have, however, never been realized, as the application appears to have been made upon mistaken views. We would call the attention of our readers to Mr. Perkins' paper upon explosions in steam boilers, published in p. 417, vol. 3, in which some remarks occur which tend to throw light upon this subject. That the expansive force of steam depended upon its density and temperature conjointly, was a fact well understood among

philosophers, but, until the publication of this paper, we believe that the influence of temperature was greatly overrated, and that of density undervalued. When heat is applied to the water in a boiler from which steam has been generated, and over which it is confined, the effect is to increase the density of the steam, by increasing the evaporation of the water; but when heat is applied to the steam, so as to increase its temperature, and cause it to transcend that of the water, its density will be thereby diminished, as a portion of the steam will be condensed by the water, in consequence of its lower temperature. Water at 212° will undoubtedly abstract heat from steam at 250°, or indeed, at any superior temperature.

Mr. Allaire may probably expect to derive some advantage from heating the steam just as it is passing into the vacuum in the cylinder, as this appears to be his intention; but we apprehend that this advantage, if any, will be very small, as the *density* of the steam in his cylinder will be less than that in the boiler.

We have thrown out the foregoing hints, because we believe that they relate to facts not generally understood, although of the first importance in the operations with steam. Were we to follow our inclinations, we should occupy several pages with our views, but as we shall frequently add remarks to the patents we publish, we think that we ought to be as brief as possible. To some of our readers who take an interest in such subjects, the view which we have taken of the importance of density in steam may be altogether novel; for their sakes we will offer one remark, with the hope of giving clearness to the ideas which we have expressed.

The force of steam results from the power which heat possesses of causing the particles of matter to repel each other; if you diminish the number of particles in a given space, you decrease the amount of repulsion, and to restore this amount the heat must be increased; and, *vice versa*, if you can contrive to increase the number of particles of matter, the amount of repulsion may be equal, although the temperature may be diminished.

We are acquainted with heat only by the effects which it produces upon other bodies; as an abstract principle it is an entire stranger to us; however highly a cylinder may be heated, its piston will remain unaffected if there be a vacuum within it, and *cæteris paribus*, the effect upon the piston will be proportioned to the quantity of matter, in the form of vapour, which the cylinder may contain.

Decision in the Circuit Court of the United States, in the case of Dr. Hull's *Patent Truss for Ruptures.*

Under the head of American Patents, we shall present not only the specifications and accounts of the patents themselves, but whatever relates to the interest of patentees generally. In conformity with this resolution we abstract from the New York Evening Post the

result of a recent trial which has taken place in that city, and shall hereafter endeavour to obtain concise reports of decisions in all similar cases. Gentlemen of the bar, are particularly invited to aid us in this department, as by so doing they will establish a permanent record of such cases, and may in this way benefit the community, and probably promote the interest of the profession.

Sir,—A suit was brought a few days since, in the Circuit Court of the United States for the Southern District of New York, for violating Dr. Hull's patent for trusses. A number of respectable witnesses were introduced on the part of the patentee, viz: Drs. Mott, Perkins, Reese, Osborne, and Stearns; and judge Thompson, in his charge to the jury, told them that it had been clearly proved that the trusses in question were an imitation of Dr. Hull's. He further remarked, that it appeared that they were of the greatest value in surgery, and had been the means of effecting cures in cases where the art had failed heretofore; had enabled persons afflicted with the disease of rupture, to pursue their business and labours without inconvenience; and in fact, its invention had formed a new era in the treatment of that disease; that the instruments sold by the defendant, the one known as Mr. Farr's, and the other as Mr. Hovey's trusses, and by them patented, are clearly infringements of Dr. Hull's patent. The jury returned a verdict for the plaintiff, to the value of the articles sold; and the court, on motion, trebled the damages, according to the statute, with costs. And it was intimated, that any further violation of the plaintiff's patent, would be restrained by injunction.

New London, July 30.

Patent Marine Rail Way.—On Monday last the ship Carrier, of nearly 400 tons, was hauled out by Mr. Miller. This is the largest vessel that has been on the ways, and we were much pleased to observe the facility with which the business was done; not the smallest difficulty presented itself. This invention proves not only to be a great convenience to ship owners, but a saving of expense in repairs. And we are glad to find the business is profitable to the ingenious and indefatigable patentee. It has not, we understand, been in his power to accommodate all applicants, as early as wished, having as yet ways for only two vessels at a time.

The above was received after the subjoined list was in type. (See p. 138.)

List of American Patents granted in June 1828. *With Remarks by the Editor.*

It is intended hereafter to publish the monthly list of patents granted in the United States, in a form calculated to render it much

more useful than the mere catalogue, which has heretofore been given. The subjoined list, for the month of June, will exhibit the Editor's views upon the subject. In the remarks which will be made, the interest of the patentee, and the rights of the public, will be equally considered. Where we think an invention manifests much ingenuity, or promises to be of great utility, we shall say so; where the subject is one of which we have not the means of forming a judgment, or where a statement of the reasons for our opinion would demand too much space, we shall merely offer an outline of the plan proposed; where we are convinced that the invention is not new, or are of opinion that it is without merit, and will not attain the end proposed, our convictions, with the reasons on which they are founded, will be made known.

There are many patents obtained, which, in the opinion of the Editor, ought not to be published until the expiration of the term for which they are granted; and he hopes, at an early day, to see the law so amended as to provide for the sealing up of the kind of patent to which he alludes, and which are technically denominated patents for 'compositions of matter.' Varnishes, compound medicines, compositions for rendering leather, cloth, or other materials water proof, and various others, are of this character. He has known persons possessed of valuable recipes, who would gladly have availed themselves of the benefit of a patent, had it offered them any security; but who have refused to obtain one, because in so doing, their processes were liable to immediate publication, and they were of a nature to be practised in secret with absolute impunity. As the Editor will, hereafter, seek to be restrained from making public such patents, it is his determination, in the interim, to impose upon himself that rule of procedure which he thinks ought to be made absolute.

PATENTS GRANTED IN THE MONTH OF JUNE 1828.

Improvement in water wheels for mills; Abel Greenleaf, of Mexico, Oswego County, New York, June 5.

The plan proposed is to employ two, or more, water wheels, where the undershot kind is used; the second wheel to be acted upon by the water, after it has left the first; the two wheels to be geared together, by an intermediate cog wheel, or to be connected by a band passing over drums upon the wheel shafts, so that, in either case, the motion of the second wheel shall be about one-third less rapid than that of the first; it being estimated that the water will strike it with a power diminished in that proportion. The fall may be divided into two parts, giving such a descent to each, as shall ensure the action to be nearly in this proportion.

Improved machinery for striking bricks, called the "Ohio brick striker;" Ebenezer Duty, and Daniel W. Duty, Geaugo County, Ohio, June 7.

This machine is too complex for a short description; its principal parts are a hopper to contain the compost, a lever to force the same down into a mould under the hopper, and a carriage and lever by which the mould is forced under the striker. The machinery is not

clearly explained in the specification, and there is no model deposited to aid us in understanding it. We are told, that the machine was essayed in this city, and not found to answer the expectation of the inventor; but whether this was from a fault in its principle or in its construction, we are not informed.

A machine, or machinery for making barrels, kegs, &c.; Nathaniel Goodall, and Loren Tainter, Watertown, Jefferson County, New York, June 9.

The machinery consists of three parts; the first, for turning the head in a kind of lathe well, adapted for the purpose; the second, is a trough, or box, in which the stave is placed, is forced forward by a follower, and is guided, and made to pass between two knives, one of which forms the rounded, and the other the hollowed side of the stave. The third instrument is a frame in which jointers are made to slide by means of suitable grooves; the staves to be jointed being secured in their proper places by means of an iron frame and cramps. The whole is worked by a shaft set in motion by any sufficient power.

An improved machine for washing, or churning; Daniel Reed, Slaterville, Tompkins County, New York, July 16.

The patents for washing machines are so numerous, and the family likeness in many of them so striking, that mere description will rarely suffice to distinguish one from another. The present machine has a box with sloping sides and a curved bottom with a dasher similar to that of many of its congeners; the dasher is fixed, and the box made to vibrate upon pins, or springs at its upper side. The novelty claimed is the extending the sides of the box upwards, so as nearly to form a triangle, and forming the door on the upper part of the side, instead of on a flat top; by which contrivance it is more effectually closed, and the suds, or cream, more completely prevented from dashing over, than in other similar machines.

An improvement in the bedstead, denominated the "drum sacking bedstead;" Harvey Wilbur, Newburyport, Massachusetts, June 16.

The mode of tightening the sacking proposed by the patentee, is to have a sliding rail, within the head and foot rails of the bedstead; this rail is confined in its place by grooves in the side rails; to the upper edges of these sliding rails the sacking bottom is firmly secured; it is then tightened by screws passing through the head and foot rails, and working in nuts in the sliding rails.

The Editor has lived upwards of half a century, and he has no doubt that he was born upon a bedstead the sacking bottom of which was tightened in this way; he cannot, it is true, remember quite so far back, but among his very early recollections are some half dozen bedsteads in his father's house, so tightened; some of them appearing as old as the Editor now is. Then why has so excellent a plan been discontinued? simply because the screw holes, the grooves, and the edge of the sacking bottom, form so many secure retreats, and breeding places for bugs, as to more than counterbalance any supposed or real advantages over the ordinary pins.

Improvement in the Franklin, or open, stove; William Cowan, Watertown, Jefferson County, New York, June 16.

A triangular tube of cast-iron, open at both ends, is made to pass, lengthwise, through the stove, so as to admit of a free circulation of air through it; this air being warmed by the heated iron is intended to economize the fuel. For an ordinary sized stove the dimensions given for the tube, are 20 inches on the front side, 18 on the back, and 10 inches in width on the top. A valve or slide is proposed near the upper part of the tube so as to regulate the draft by opening or closing the throat.

The cast-iron tube will, we think, be found but little better than the plan of leaving the back of the ordinary Franklin stove exposed to the air of the room, as is frequently done in setting it. Heated tubes of this kind offer but little advantage, excepting a current of cold air, from without the room, is in some way admitted into them; their heated air will otherwise pass out very slowly indeed, and the radiation from the hot surface of iron, being confined within the tube, will scarcely affect the temperature of the air in the room.

Improvement in the mode of manufacturing spirituous liquors from the liquid and sediment usually called still slop; David White, Fredonia, Chatauque County, New York, June 17.

The specification states that the discovery consists in using the liquid sediment, and flour and meal, of grain, and other materials used in distillation, which has been once fermented, and producing a new fermentation, and re-distilling it. The still slop is to be drawn off into clean tubs, cooled down to between 75 and 100° of heat, to have lime, potash, or some other alcali added, to correct, or counteract its acidity; when this is effected and the slop is at a proper temperature, good distillers' yest is to be added, in the ordinary quantity; it is to be allowed to ferment from two to four days, and then distilled. A considerable quantity of spirit will, it is said, be thus obtained.

Improvement called the "armed saw frame," Samuel Sperry, Sparta, Wilson County, Tennessee, June 18.

This proposes to dispense with the fender posts in which the saw-frame usually slides; to attach jointed levers at right angles to the four corners of the saw frame, so as to allow said frame to work up and down in the ordinary manner. Two of the jointed levers may be attached in front of, and two behind the saw, or the whole four may be placed on one side.

This is all that is given, and we confess that we should be a little surprised to see a straight kerf produced by a saw so hung, without something equivalent to the fender posts.

Improvement in the grist mill; Joseph Crail, Warren, Trumbull County, Ohio, June 19.

In this mill the upper stone is to be stationary, and the lower stone to turn; this is not claimed as a novelty; but it is proposed to use very small stones, say of 18 inches diameter, to give a much

more rapid motion than usual, to prevent the heating of the grain by grinding nearer the centre of the stone than has hitherto been done; these, with the manner of preserving a true balance in the under stone, are the improvements gained; it is said that a mill of this kind will do more, and better work, than the ordinary mill, and that with a less expenditure of power.

An engine or machinery for propelling boats, &c. called "Talbot's Atmospheric Propelling Engine;" Edward Allen Talbot, late of Dublin, in Ireland, but now residing in the United States, granted in pursuance of a special act of Congress, June 21.

This will hereafter be described more at large, but as preparations are now making to test the correctness of the principles on which it is founded, and also the force with which it will act, an analysis would at this time be premature. We will, therefore, merely state that by the aid of two atmospheric cylinders, placed horizontally, with their open ends towards the stern of the boat, the pistons of which cylinders are to be operated upon by means of a steam cylinder, or cylinders, it is proposed to obtain a power, acting within the vessel itself, without the aid of paddle wheels, or any substitute therefor, which shall propel a boat with great velocity.

Machinery for making casks, barrels, tubs, &c.; John Hale, Oakam, Worcester County, Massachusetts, June 21.

The staves are first formed by being forced through a machine in which a cutter, or shaver, forms the convex side, whilst a wheel provided with a number of cutters, forms the concave side; the axis of this cutter wheel is in a line with the stave, and of course, the cutters traverse the grain of the stuff to be worked.

The staves are jointed by passing under another cutter wheel, which, instead of being cylindrical, is hollowed from each edge, so as to be of less diameter in the middle than elsewhere; the staves are passed under this so that they are jointed with the required bulge in the middle.

The heads are turned in an apparatus very similar to that described in Goodal & Tainter's patent.

The hoops are shaved, or cut, regularly, by a cutter wheel, similar to that first described, there being a regulating guide to govern their thickness.

Improved mode of fixing the compass on board of vessels; Lemuel Langley, Gosport, Virginia, June 23.

The specification of this patent we have already given in p. 129.

A machine, or machinery called the "dormant balance," for the cure of crooked, or inflected spine, James K. Casey, New York, June 23.

A gentleman, who is no mean judge in such cases, has pronounced this apparatus "beautiful and perfect," and has declared it as his opinion, that, "although the most eminent surgeons have been able only to arrest the progress, this machinery must clearly and safely effect the cure, of crooked spine, and its attendant evils."

We shall, at an early period, give the drawings and description of this apparatus, and therefore need not attempt the latter at present.

For a method of setting stills, boilers and kettles for distilleries, &c.; John Miller and Benton Clemmons, Clemmonsville, Davison County, North Carolina, June 24.

The plan described is to cause the flues to be so constructed that the flame from one fire may be made to circulate around two, three, or more stills, or boilers; the description and drawings are too imperfect to allow us to judge of the merits of the plan.

Improved curriers' knife; Isaac H. Harrington, Penn Yan, Yates County, New York, June 25.

The knife is to be made of the blade of a saw-mill saw, from which it is to be cut cold; a metal bar, embracing each side, is to be firmly rivetted along the middle of the blade, and to the projecting ends of this the handles affixed in the usual manner.

Improvement in the mule for spinning cotton; Thomas Walker, Chester County, Pennsylvania, June 26.

The fly wheel of the mule is to be made so that it can be thrown out of gear, so that the shaft may turn without being acted upon by the wheel. The shaft has two wheels, the one for bringing the carriage out, the other for taking it in. This is to accommodate it to the purpose of dispensing with the ordinary manual labour, and to cause it both to back off and wind up without this aid. It would, obviously, be in vain to attempt to describe movements which must necessarily be extremely complex; we shall probably publish the whole patent.

Improvement in the mode of raising ships, or vessels, and other bodies from the water to repair, and exhibit them to view; John H. Green, Providence, Rhode Island, June 26.

A view of the proposed improvements would demand plates, and descriptions at length; we may, hereafter, take it in hand, but shall wait to hear of the practical operation of the machinery.

A machine called the "domestic spinner;" Edward Penny Adams, Jefferson County, New York, June 27.

This is for spinning wool, in a manner similar to various other machines for domestic use, which have been contrived, to spin several threads at once. The whole machine is described, without a particular specification of what is claimed as new; should we, on comparing it with some others in the patent office, think it possesses any superiority, it shall again be heard of through the medium of the Journal.

A new medicine, being cough drops, for the cure of coughs, colds, consumptions, and other affections of the breast and lungs; Daniel E. Smith, Cornwall, Litchfield County, Connecticut, June 30.

Method of rendering leather water proof; Abraham Straub, Milton, Pennsylvania.

For reasons already stated, we omit the recipes contained in the two last patents.

List of Patents granted in the United States, in April and May, 1828.

FOR INVENTIONS AND IMPROVEMENTS.

In the mode of sawing shingles, called the "Gauge Saw Shingle Machine;" Cheney Read, of Western, Worcester County, Massachusetts, April 2.

In constructing bellows or blowing machines; Elijah Brady, Mount Pleasant, West-chester County, New York, April 3.

In the manufacture of cooper's work; Hiram Waters, Watertown, Jefferson County, New York, April 3.

In an oven for baking over a cooking furnace; Eli Moody, Northfield, Franklin County, Massachusetts, April 5.

In a safety compass lamp; Joseph Feinour and Joseph Feinour, jr., Philadelphia, April 5.

In making terro metallic teeth; Anthony Plantou, Philadelphia, April 5.

In the machine for carding wool; Henry A. Shannon, Columbia County, New York, April 5.

In raising water by vacuum, produced by steam; together with an improvement in mill gearing; Joseph S. Fox, Otto, Cattaragus County, New York, April 5.

In the art of distilling by steam; Benjamin Barr, Strasburg Township, Lancaster County, Pennsylvania, April 5.

In the machine for shearing cloth; Isaac Kellogg and George C. Kellogg, New Hartford, Litchfield County, Connecticut, April 7.

In the mode of transporting carriages, &c. on the inclined planes of rail-ways; Moncure Robinson, Henrico County, Virginia, April 9.

In the thrashing machine; John H. Bennet, of Aurelius, Cayuga County, New York, April 10.

In the fire engine; Ezekiel Daboll, Canaan, Litchfield County, Conn., April 10.

In locking hind wheels of wagons, &c., called "the Franklin lock;" George Diven, of Franklin County, Pennsylvania, April 14.

In the mode of obtaining water; Timothy Davis, Lawrence Township, Dearborn County, Indiana, April 14.

In the mode of manufacturing paper from a marine production, or sea grass, or weed, designated by botanists as "ulva marina;" Hayden Collier, Plymouth County, Massachusetts, now in London, England, April 15.

In the mode of making sugar boxes by machinery; Paul Pearson and John Howe, Alma, Lincoln County, Maine, April 15.

In medicine; Fitzgerald Bird, Hancock, Georgia, April 16.

In the machine called Brown's reel for tanning or handling hides, skins, &c.; William Brown, Frankford, near Philadelphia, April 17.

In the thrashing machine; Calvin Emmons, of New York, April 17.

In the mortising machine; Wm. E. Marsh, Westfield Township, Essex County, New Jersey, April 18.

In the machine for planting and cultivating cotton; Richard Herbert, Williamson County, Tennessee, April 19.

In canal boats; Benjamin Phillips, Philadelphia, April 21.

Improvement on Benjamin F. Brown's standing press frame; Robert Hoe, New York, April 22.

In the revolving hydraulic engine; Asahel Hubbard, Windsor, Vermont, April 22.

In the cogging machine; James A. Post, of Warwick Township, Orange County, New York, April 23.

In the common carriage axle; Daniel W. Phillips and William Maher; the first of Middlebury, and the last of Covington, New York, April 23.

In the churn; Edward Spain, Mount Holly, Burlington County, N. J., April 23.

In the machine for spinning wool, &c.; Arthur Cretchfield, Union Township, Licking County, Ohio, April 24.

A composition for making roofs fire and water-proof; Daniel Greer, Pittsburg, Pennsylvania, April 25.

In the lever press, William Linn, Danville, Pittsylvania County, Virginia, April 25.

In the plough; John Deats, Middletown, Bucks County, Pennsylvania, April 26.

In the method of effecting the rotary motion directly from the alternate rectilinear motion of the steam piston, Peter Cooper, New York, April 28.

Improvement, called a portable oven. Francis L. Hedenberg, New York, April 26.

In saw-mills; Isaiah Call, Woodstock, Windsor County, Vermont, April 28.

Improvement, called the oyster platform, John Vreeland, of New York, April 29.

In the printing machine or roller press; George W. Cartwright, Mount Pleasant, West Chester County, New York, April 29.

In the art or process of testing leaden pipes for conveyance of water, Theophilus Packard, Shelburn, Franklin County, Massachusetts, April 29.

In the corn shelling machine; Wm. Hoyt, Vernon, Jenning County, Indiana, April 29.

In the saddle; Alexander Marshall, Pikeland Township, Chester County, Pennsylvania, April 30.

In the mode of communicating power and motion by means of metallic bands; Joseph Eve, of Augusta, Georgia, May 1.

A machine for sawing hoops, basket stuff, stuff for making riddles, window curtains and window blinds; Phinehas Slayton, Lockport, New York, May 1.

On Isaac Leavitt's washing machine; Eli M. Gibbs, Chenango County, New York, May 1.

In the mode of raising and lowering canal boats, without the aid of locks; William Wiard, Avon, Livingston County, New York, May 1.

In the washing machine; Moses P. Parker, Lowville, Lewis County, New York, May 1.

In the spring and valve marine propeller, William Willis, Charleston, South Carolina, May 2.

In the construction of bedsteads; Silas Hyde, Arcadia, Wayne County, New York, May 2.

In the percussion lock for fire arms; Oren Moses, Malone, Franklin County, New York, May 3.

A machine for cutting plugs for waists and decks for shipping. (This patent was issued on the 28th of June, 1826, and re-issued on account of a defective specification, bearing the same date.) Charles Josselyn, New York, May 3.

In the wheelwright's fellow-lathe; John Setton, Pendleton, and James A. Black, Columbia, S. C., May 5.

In the rope reeding machine; Abraham Boring and William W. Jones, Thornville, Perry County, Ohio, May 5.

In the double shooting gun or rifle; Silas Mosher and Noble White, Hamilton, Madison County, New York, May 5.

In percussion locks; Jedediah Caswell, Manlius, Onondago County, New York, May 8.

In the cooking stove; Abraham Fisher, Claremont, Sullivan County, New Hampshire, May 9.

In the water wheel, for propelling machinery, &c.; John Bell, Sycamore Township, Hamilton County, Ohio, May 9.

In the machine for breaking hemp; John S. Van De Graaff, Scott County, Kentucky, May 12.

In the machine for spinning wool and cotton from the roll; William R. M'Call, Vincennes, Knox County, Indiana, May 12.

In making clay pipes; Thomas Wickersham, Newbury, York County, Pennsylvania, May 13.

In tanning and manufacturing hides into leather; Ebenezer Shove and Thomas Hunt, Locke, Cayuga County, New York, May 13.

In the improved method of making glass furniture knobs or handles, for which letters patent of the United States, bearing date the 9th day of September, 1824, were granted unto John P. Bakewell, of Pittsburg; Thomas Bakewell and John P. Bakewell, Pittsburg, Pennsylvania, May 14.

In the boilers of steam engines; James P. Allaire, New York, May 14.

In the machine for cutting leather in the manufacture of shoes; George P. Mitchell, Burlington, New Jersey, May 15.

In the mortar for pounding rice; John Ravenel, Charleston, S. C., May 17.

In distilling spirits from grain and fruit; Jacob Hugus, Hempfield Township, Westmoreland county, Pennsylvania, May 17.

In the machine for cutting pegs; Hezekiah Thurber, town of Painted Post, Steuben county, New York, May 22.

In the mode of making shingles by machinery, called the Howe and Chaffin Shingle Machine; Stilman Howe and Charles Chaffin, Holden, Worcester County, Massachusetts, May 22.

In the saw frame for sawing veneers for cabinet work, and window sash, and window blind stuff, and tenons, May 22.

In the copperplate printing press; Cyrus Durand, New York, May 22.

In preparing straw, hay, or other vegetable substances, for the

manufacture of paper, William Magaw, of Meadville, Crawford County, Pennsylvania, May 22.

In the machine for cutting and forming wooden screws; Stephen Treadwell, Western, Fairfield County, Connecticut, May 22.

In the thrashing machine; Norton Case, North Granville, Licking County, Ohio, May 22.

In the mode or manner of pressing oil out of flaxseed, and other oleaginous seeds; Charles How, Moretown, Washington County, Frederick Brewster, of Colchester, and John Johnson, Chittenden, Burlington County, Vermont, May 24.

In the percussion gun lock; Joseph Lawrence, New Berlin, Chenango County, New York, May 24.

In the washing machine; George Hancock, Maysville, Mason County, Kentucky, May 24.

In the machine for the manufacture of horse shoes; Robert E. Horbart, Pottstown, Montgomery, Pennsylvania, May 24.

In the marine rail-way; John H. Greene, Providence, Rhode Island, May 26.

Improvement, being an oil boiler, or bain marie of oil, for use in refining sugar, and for other purposes, William Augustus Archbald, of New York, May 29.

For a double boiler and other apparatus for refining sugar, and for other purposes; William Augustus Archbald, of New York, May 29.

In the filtering apparatus, to be used in sugar refining, and for clarifying liquids in general; William Augustus Archbald, New York, May 29.

In the mill for breaking and grinding tanners' bark, and corn in the ear; John Montgomery, Sangerfield, Oneida County, New York, May 29.

In the gun lock; Nathaniel Saltonstall, New London, Connecticut, May 29.

In the cylindrical printing press; Charles G. Williams, New York, May 29.

In the mode of manufacturing hat bodies, by machinery, at one operation; George L. Thatcher, of Brooklyn, King's County, New York, May 31.

In machinery for propelling ships and other vessels; Anthony Hermange, Baltimore, May 31.

LIST OF ENGLISH PATENTS.

List of patents for New Inventions, which passed the Great Seal, in England, from January 26, *to April* 19, 1828.

To John Weiss, surgical instrument maker; for improvements on instruments for bleeding horses, and other animals—26th January.

To Augustus Applegath, printer; for improvements in block printing—26th January.

To Donald Currie; for his method of preserving grain, and other vegetable and animal substances, and liquids—31st January.

To William Nairn, mason; for his improved method or methods of

propelling vessels through or on the water, by the aid of steam, or other mechanical force—5th February.

To Caleb Hitch, brick-maker, for his having invented or found out an improved wall for building purposes—21st February.

To George Dickinson, paper manufacturer; for his invention of an improvement or improvements in making paper by machinery—21st February.

To Angelo Benedetto Ventura, professor of music; for his having invented certain improvements on the harp, lute, and Spanish guitar —21st February.

To Thomas Otway, iron master; for his new invented expedient for stopping horses, when running away with riders or in carriages—21st February.

To David Bently, bleacher; for his having invented or found out an improved method of bleaching and finishing linen or cotton yarn and goods—21st February.

To William Brunton, civil engineer, for his having invented certain improvements on furnaces for the calcination, sublimation or evaporation of ores, metals, and other substances—21st February.

To John Levers, machine-maker; for his having invented or found out certain improvements in machinery for the manufacture of bobbin-net lace—3d March.

To William Poronall, weaver; for his new invented improvements in making healds for weaving purposes—6th March.

To Barnard Henry Brook, civil engineer, for his new invented improvements in the construction and setting of ovens and retorts for carbonizing coal for the use of gas-works—6th March.

To William Roger, lieutenant in our royal navy; for his invention of certain improvements on anchors—13th March.

To Robert Griffith Jones, in consequence of a communication made to him by a certain foreigner residing abroad, for an invention of a method of cementing China, and certain other compositions, which he denominates letnophanic, translucid, or opaque china—13th March.

To George Scholefield, mechanic; for his invention of certain improvements in, or additions to looms for the purpose of weaving woollen, linen, cotton, silk, and other cloths—13th March.

To Nathan Gough, civil engineer; for his having invented or found out an improved method of propelling carriages or vessels by steam or other power—20th March.

To Samuel Cligg, civil engineer; for his invention of certain improvements in the construction of steam engines, and steam boilers, and generators—20th March.

To Jane Bentley Lowrey, straw hat manufacturer; for certain improvements in the manufactory of hats and bonnets—25th March.

To Edward Cowper, gentleman; for certain improvements in cutting paper—26th March.

To Ferdinand de Fourville, merchant; for certain improvements in filtering apparatus—26th March.

To Thomas Lawes, lace manufacturer; for improved thread, to be used in the manufacture of the article commonly called bobbin-net lace—29th March.

To Henry Marriott, ironmonger, and Augustus Siebe, machinists; for improvements in hydraulic machines—29th March.

To Peter Taylor, flax dresser, being one of the people called quakers; for certain improvements in machinery, for hackling, dressing, or combing flax, hemp, tow, and other fibrous materials—29th March.

To John Davis, sugar refiner; for an improvement in boiling or evaporating solutions of sugar and other liquids—29th March.

To Charles Harsleben, Esq.; for certain improvements in machinery to be used in navigation, chiefly applicable to the propelling of ships, and other floating bodies, and which improvements are also applicable to other purposes—3d April.

To Lemuel Wellman Wright, engineer; for improvements in the construction of wheel carriages, and in the machinery employed for propelling, drawing, or moving wheel carriages—15th April.

To John Gottlieb Ulrich, chronometer maker; for improvements in chronometers—19th April.

NOTICES.

THE ROMANCE OF THE RATTLESNAKE.

Just as the Editor was leaving Philadelphia for Washington, he was pressed for 'more copy' by his printer, and hastily marked some articles for insertion, among which were '*Notes on the Rattlesnake. By* John James Audibon, F. R. S. E., M. W. S., &c. Time did not admit of reading the article, but it was seen that the writer professed to offer the 'fruits of many years' observation, in countries where snakes abound.' This, with his titles, and the bold and splendid assurances which we had seen respecting the publication of his works, served as a password to his tissue of falsehoods, which would have been expunged from the proof, but for absence from the press.

We had determined to publish a notice like the foregoing, when we received a note from a scientific friend, whose remarks are, at once, so pointed, and correct, and so fully express our own ideas upon the subject, that we gladly adopt, and insert them.

"It is a tissue of the grossest falsehoods ever attempted to be palmed upon the credulity of mankind, and it is a pity that any thing like countenance should be given to it, by republishing it in a respectable Journal. The romances of Audibon, rival those of Munchausen, Mandeville, or even Mendez de Pinto, in the total want of truth, however short they may fall of them in the amusement they afford."

SUBSCRIBERS IN PATTERSON, NEW JERSEY.

Subscribers who account with the agent at Patterson, New Jersey, are particularly requested to observe that Messrs. Day & Burnett, are now the only agents of the work there; all payments whether for arrearages, or otherwise, must be made to them alone.

W. C. on the adhesion of disks, requires an engraving. He shall appear in our next.

THE

FRANKLIN JOURNAL,

AND

AMERICAN MECHANICS' MAGAZINE;

DEVOTED TO THE

USEFUL ARTS, INTERNAL IMPROVEMENTS, GENERAL SCIENCE,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

SEPTEMBER, 1828.

Directions for bending, blowing, and cutting of Glass, for chemical and other purposes. Extracted from Chemical Manipulation. By MICHAEL FARADAY, F. R. S.

[Continued from p. 99.]

21. The operation next in simplicity is bending a tube, requisite for the making of syphons, tube retorts, and tube operations of all kinds. An unpractised person will effect this most easily with a piece of tube about six or seven inches in length, half an inch in diameter, and the twelfth or fourteenth of an inch in thickness. Such a piece is easily handled, retains its heat longer than a smaller or thinner tube, and requiring more power to bend it, it is for that reason more steady in the hand. Being heated in the manner already described (3,) nothing will be found more easy than to bend it: but if this be done hastily or inattentively, the bend will be of a bad form; contracted in its channel; thin in one part and thick in another; probably wrinkled and distorted, and then very liable to crack on cooling.

22. To avoid these errors, when the glass is uniformly heated for the length of half an inch or more, and to such a degree that it is manifestly soft by the feel, it should be taken out of the flame; and the two ends being now simply inclined in opposite directions, but without any other tendency by the hand, the glass is to be bent gradually in such a direction that the convex part shall be towards the eye. The operation should be continued until the required degree of curvature or the desired angle formed by the two straight parts is attained, or until the glass from cooling has become too hard to yield; in the latter case it must be re-heated, and the operation completed.

The heat should be nearly uniform all round the glass, that on applying force, all the parts may give way together, the glass at the convex surface being extended to a certain degree, and drawn out, whilst that at the concave surface is equally but uniformly thickened by its necessary contraction into a smaller space. If the glass be much hotter, and consequently much softer, on one side than the other, weakness or distortion of the bend usually happens. For if the hot part be on the convex side, it yields during the operation much more than the stiffer glass on the cooler part, which consequently undergoes but little contraction, whilst on the contrary the soft glass is extended considerably, rendered very thin, and usually assumes a flattened form. Or if the hotter part be on the concave side of the bend, the cooler and convex part will scarcely extend during the operation, the hot glass beneath giving way to the force, and becoming generally thrust up into a sharp fold or into wrinkles. Or if the hotter surface be on one side of the bend, then the glass, yielding more easily on one side than the other, usually acquires an irregular and disturbed form. On the whole, it is better that the heat should be somewhat greater on the convex than on the concave part, inasmuch as, though it yields rather more than it ought, it is not so readily formed into wrinkles, and also because it cools more rapidly than the concave side. This more rapid degree of refrigeration depends upon the fact that the glass on the convex side becoming extended and thinner, consequently loses heat faster than the concave part, which, owing to contraction during the operation, becomes thicker; this circumstance may therefore be compensated by a little extra heat at the first.

23. If the glass be too hot, it gives way so readily during the operation as to assume irregular forms, and sometimes, especially in sharp bends, becomes flattened; the convex and concave sides approaching each other, and the lateral portions extending outwards. This particular condition is even useful occasionally, as it prevents the necessity of great extension or contraction of the glass on the convex or concave surfaces; but an irregular and wrinkled bend should never purposely be allowed, the bore of the tube being preserved nearly as round and free there, as elsewhere. If a part be observed on bending to lose its proper form, and to become flattened or wrinkled into folds, from the heat being either too great or irregular, that part should be allowed to cool a little whilst the heat is applied to the neighbouring portions, particularly to such as by contraction on the concave, or expansion on the convex sides, during the continuance of the operation, are likely to rectify the irregularity of form just commencing.

Thin and small tube will require much less heat and generally more care, than that which is thick or large; but it is the degree of softness which, indicated by the feeling, must principally guide the operator in his proceedings.

24. When a considerable bend is to be made, the angle formed by the two arms being very small, as in a syphon for instance, it should not be effected entirely at one particular part of the glass, but a portion having been heated and bent as far as possible, without weaken-

ing or distorting the tube or contracting the bore, the neighbouring parts should be heated and the curvature continued until the desired inclination of the two arms is obtained. Small and thick tube may be bent more sharply than large or thin tube, the latter requiring greater extent of curvature for the preservation of the proper form.

25. When, during the operation of bending, different parts are to be heated and bent in succession, it is best to begin the operation at one end of that part, over which it is to extend, and gradually proceed from it to the other end. By thus proceeding, the operator may contrive, when one part is heated and ready to be curved, to remove it sideways from the flame, so as to bring the next portion into the heat, which will then be acquiring temperature, whilst the former part is bending, and in consequence of its previous high temperature resulting from mere vicinity, will soon be in a properly heated state. This transition, as it were, of the tube through the flame, must not take place irregularly, but gradually, the heating and bending going on without interruption, and over successive portions of the tube, at the same time. A clear idea of the manner in which this is to be done, and very useful first practice, may be easily acquired by using a spirit-lamp flame without a blow-pipe, and drawing a piece of quill tube through it so gradually, that the part in the flame shall be heated red hot before leaving it. It will then be found that by giving lateral pressure on one end of the tube the parts will be bent and curved in succession as they become heated, and fixed as by their motion onwards they become cooled.

26. When the flexure is required so near the end of a piece of tube as to render it impossible to hold the shorter side with the fingers, the force required must be given by pressing against the end with a piece of wood or another piece of glass tube. But if the bend is to be continued to the very extremity, then wood or glass will not answer the purpose, for the first would burn and soil the tube, and the last, melt and adhere to the heated part. In such cases cold metal, as a metallic rod, is the best adapted for use, but it should be applied only at the moment when pressure is wanted, and never be retained so long in contact with the hot glass as to reduce its temperature below the point of softness; for as soon as the glass becomes solid, the cold metal would crack it. For the same reason, metal should not be used in the cases where wood and glass have just been recommended, as it would probably crack the hot, but solid, part of the glass. Whenever cold metal is brought into contact with glass for the purpose of moulding or working it, the glass should be hot and not be allowed to cool to its point of hardness. The metal itself should always be cold in such cases, or at least not very hot, otherwise it will adhere to the glass and cause injury; neither should it be small, like a wire, lest the glass itself should communicate so much heat as to cause its adhesion. If the metal be hot, and the glass below its soft point, they may be brought together without risk of fracture to the glass.

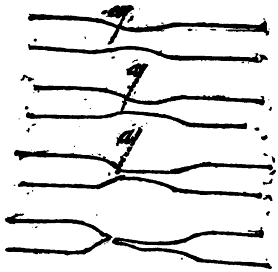
27. Quill tube, as has been already remarked, may be bent in the flame of a spirit-lamp. It may also be bent over the glass of an ar-

gand lamp in good combustion. Larger tubes may be curved over a charcoal fire, either in the crucible furnace, or arranged on a piece of metal plate. Their flexures are large and gradual, not so short and sharp as those effected by the lamp and blow-pipe. Cooper's lamp furnace is a very excellent instrument for softening considerable lengths of tubes when the bend required is to be very gradual and extensive. The tube should be continually moved in the flame, both with a lateral and rotatory motion, until uniformly heated to a sufficient degree.

28. The next operation to be described is equally useful with the last: it is that of closing the extremities of tubes so as to shut up one end and form those useful vessels already often referred to. This operation is most readily performed with a piece of straight tube, open at both ends, and long enough to make two closed tubes. Let it be therefore supposed that a piece of tube, such as that before mentioned (21,) is now to be formed into two tubes, each closed at one extremity.

29. The piece of tube is first to be heated in the middle; but in place of endeavouring to extend the heated part as far as possible, it should rather be contracted into a narrow ring (10.) The hands are then to be separated, the glass being pulled in the direction of its length, when it will be found to elongate, and at the same time contract in diameter at the hot and soft part. Some degree of management in the heat is now required. If it were still to be urged upon the middle of the contraction, and the pulling force also continued, the tube would suddenly be divided into two parts with irregular, long and pointed terminations. For as the glass is drawn out, and the diameter as well as thickness diminished, the flame acts upon it as if it were a smaller tube; the smallest part is consequently always hottest, it yields most readily to the force applied, and thus the hasty and imperfect result mentioned would be obtained. If, on the contrary, to avoid this, the glass were moved so that the flame fell upon and heated the portions at the side, then their softness might be made to surpass that of the contracted part of the tube, and the pulling would merely tend to elongate and contract this part also, and so to reduce, as it were, the whole of the tube to portions of tube of greater length but smaller diameter.

30. It is an effect between these that the operator should produce. As soon as the glass yields to the pull, and in proportion as the diameter diminishes, he should relax the force so as to apportion it to the softness of the glass, and proceed gradually with the operation; he should at the same time move the glass towards the extremity of the flame, and even out of it, that he may be able to moderate the heat and apply it principally to a small surface. He should no longer endeavour to keep the two pieces of glass of equal form, but using one as an adjunct, turn all his attention to finishing the extremity of the other, which probably will be that in his left hand, because the piece in his right hand becomes the tool with which he works, and which is most adroitly used by it. Directing, therefore, the point of the flame upon what is to be the bottom of the closed tube, a little above the



thinnest part, but still not so much above as to render the thicker part the softest, let him carefully retract his right hand, by which operation the narrow part will become more and more attenuated, and finally, when capillary, fuse and separate. The end of the tube will be left closed of a round form, with probably a little knob of glass at the middle of the bottom, whilst the other piece will be drawn out rather irregularly, though closed also at its extremity. The accompanying wood-cut illustrates the successive changes in the form and appearance of the tube; the part to which the greatest heat should be applied, being pointed out by the lines *a a a*.

31. The tube is seldom perfectly finished by this operation. To complete it, the knob of glass at the end, if small, and the whole of the bottom of the tube, should be heated until the glass is soft. Then applying the open end of the tube to the mouth, and propelling air into it with a degree of force proportionate to the heat of the glass, it will yield, the knob expanding more than any other part, because of its greater temperature, and of its continuing for a greater length of time in a soft state. In this manner, by a little address, the knob may be made to disappear, and the bottom of the tube to assume a regular, round form, and a thickness nearly equal in every part.

32. If the knob be so large and clumsy in consequence of the partial failure of the first operation, that if heated so as to run up and make part of the bottom of the tube, it would cause the formation of a very thick portion of glass there, then it must be removed. For this purpose it is to be heated, and a piece of waste glass previously warmed in another part of the flame while held in the right hand, applied to it: then directing the point of the flame above the junction and against the part intended for the bottom of the tube, the glass should be melted, the thick clumsy knob drawn off, and a fresh closing of the tube effected and finished as before. Or if, from want of practice, the end of the tube be irregular, misshapen, and altogether bad, then after attaching the piece of waste tube, which serves as a tool, the heat is to be applied a little way up the tube, the glass softened in another place as near to the first as possible, and the operation recommenced; the piece of glass at the end being drawn off and managed by means of the fragment of tube which had been attached to it for the occasion.

33. If the end of the tube when finished be thin, it should be raised to a red heat, with a little of the neighbouring thicker part, when it will gradually contract and thicken, and it may thus be made of equal strength with the sides of the tube. Its thickness must be judged of by inspection, in the manner formerly described. On the contrary, if it be too thick, it may be rendered thinner by being blown out as mentioned above (31.) The precautions requisite in doing so will be immediately described (52, 56.)

34. Having finished one of the tubes to be formed out of the original piece, the other, which had been laid down, is to be resumed and completed. For this purpose, when held in the left hand, the point of the flame is to be directed as before mentioned upon that part of the contracted termination, which is to form the bottom of the tube, and when soft the tail of glass is to be drawn off in the manner just described for removing a knob (31.) The tube is then to be finished according to the directions already given (31.)

35. When the piece of tube to be operated with is thin, the extent of surface heated at first must be greater, and the operation carried on more carefully, than is necessary with thicker tube. For if a small extent only be heated, and then drawn out quickly, the glass becomes so attenuated, that when very hot it will of itself run into holes, or if it remain undivided, will form a bottom to the tube, so thin that it will not be safe to trust such a vessel for an experiment, lest a slight accident should break it. In this case, after the tube is partly drawn out and its diameter contracted, the heat should be raised considerably but uniformly round the thin narrow part, and the glass being retained in an undisturbed state, should be allowed to draw together and thicken. When that has taken place to a sufficient degree, it is again to be drawn out, and if a second time it become too thin, it must be thickened as before: in this manner the operation must proceed, until the bottom is closed and completed.

36. When a piece of tube is too short to be formed into two tubes, it must be sealed at one extremity: an operation often required for other purposes. In these cases, the end to be sealed must be heated carefully (6,) the tube being inclined a little with the heated aperture towards the direction of the course of the flame, that the force of the blast may not throw hot air into and along it, and burn the hand at the other extremity; and also that the products of the combustion may in other cases be prevented from entering the tube and affecting the substances already placed within it. When the end is soft, a piece of waste glass tube is to be held in the right hand, and its extremity used to press the sides of the hot end together, and when three or four places on the edge have been made thus to approach each other, the end of the spare tube is to be attached to them, and the heat being raised a little above its termination, the piece is to be drawn off, and the operation proceeded with exactly in the manner already described (30, 32.)

On the preparation of the Silver Gilt Wire, used in the Manufacture of Gold Lace, and for other purposes. Extracted from Dr. WILLIAM LEWIS'S *Commercium Philosophico-Technicum.*

(Concluded from p. 90.)

THE rolls, as well as the drawing-plates, have been often procured from France: and it has been thought that the wire received from

the French rolls an additional beauty and lustre; though it does not appear that the French have any durable advantage in this respect above the English, or that the glossiness communicated by either is of any real advantage to the manufacture, for it quickly goes off. The most important point, in their preparation, is, the giving them that perfect truth and equality of surface, which the flatting of so fine wire demands. The internal part is formed of iron; and a plate of refined steel is lapped round, and welded over the iron. Where the two ends of the steel plate meet, there is frequently an imperfection, the juncture being generally visible across the surface of the roll. In rolls of great width, some curious artists have obviated the inconveniences arising from this cause, by using, instead of a broad plate, a long narrow bar of the steel, and twisting it round the roll in several circumvolutions; that the little inequalities, in hardness and solidity, happening at the junctures, might be in the direction of the riband that passes between the rolls, and not transverse to it. In the narrow rolls, used for the flatting of wire, a practice of this kind would be very difficult; but the same end might, perhaps, be answered, and even more effectually, by casting the steel, instead of a straight bar, into the form of a hoop or ring, of a somewhat less diameter than the size of the intended roll; then forging the hoop, on the round beak and flat of the anvil, alternately, to procure it the requisite uniformity of its parts, and the due extension; afterwards placing it in a proper mould, fixing the axis in its due position, and running into the intermediate space some cast-iron, which, from its known property of expanding, as it sets or becomes solid, will continue every where to fill the cavity, and irremoveably fix itself, both to the hoop and to the axis.

The degree of extension of Gold, in Wire and Leaf.—The vast extent to which gold is apparently stretched, in the foregoing operations, has induced several persons to make experiments, for determining its exact degree, by mensuration and weight. In an experiment of Reaumur's, forty-two square inches and three-tenths of gold-leaf weighed one grain troy; and Mr. Boyle found that fifty and seven-tenths weighed but a grain. As a cubic inch of fine gold weighs 4902 grains, the thickness of the gold leaf, examined by the one, was the 207,355th; and of that by the other, only the 248,532nd part of an inch.

Dr. Halley found, that, of superfine gilt wire, six feet weighed a grain. M. de Reaumur makes about four inches more go to the same weight; and Mr. Boyle is said, if there be no error in the numbers, to have had gilt wire much finer than any of these. Allowing six feet to make a grain, and the proportion of gold to be that commonly used by our wire-drawers, the length to which a grain of gold is extended on the wire comes to be near 352 feet.

In flatting, the wire is extended, according to M. de Reaumur, one-seventh part of its length, and to the width of one ninety-sixth of an inch: in some trials I have seen made by the workmen, the extension in length appeared less, but that in breadth so much greater, that the square extension was at least equal to that assigned by

Reaumur. Hence, one grain of gold is stretched on the flatted wire, to the length of above 401 feet; to a surface of above 100 square inches; and to the thinness of the 492,090th part of an inch.

M. de Reaumur carries the extension of gold to a much greater degree. He says the wire continues gilded, when only one part of gold is used to 360 of silver; and that it may be stretched, in flatting, one-fourth of its length, and to the width of one forty-eighth of an inch. In this case, a grain of gold must be extended to 2900 feet, or upwards of half a mile; and covers an area of more than 1400 square inches. He computes the thickness of the golden coat, in the thinnest parts of some gilt wire, to be no more than the fourteen-millionth part of an inch; so that it is only about a hundredth part of the thickness of gold leaf. Yet, notwithstanding this amazing tenuity, if a piece of the gilt wire be immersed in warm aquafortis (nitric acid,) which will gradually dissolve and eat out the silver, the remaining golden coat will still hang together, and form, while the fluid prevents it from collapsing, a continuous opaque tube. To succeed in this experiment, the aqua-fortis must not be very strong, nor the heat great; for then the acid, acting hastily and impetuously upon the silver, would disunite the particles of the gold.

Whether any other metal can be extended to an equal degree, is not yet as clear; for, as it is the great value of gold which engages the workmen to endeavour as much as possible to stretch it to the largest surface, the same efforts have not been made in regard to the less valuable metals: to make a fair comparison, trial should be made of extending silver upon the surface of gold, in the same manner as gold is extended upon silver. It may be observed, also, that, as gold is nearly as heavy again as silver, or contains nearly double the quantity of matter under an equal volume; so, if equal weights of the two metals be stretched to equal extents, the silver will be little more than half the thinness of the gold; and conversely, if silver could be brought to equal tenuity with gold, in regard to bulk, it would, in regard to quantity of matter, be nearly of double extensibility.

Application of gilt wire on other bodies.—There are various methods of applying the gold, thus extended, to cover the surfaces of other bodies. For laces and brocades, the flatted gilt wire is spun on threads of yellow silk, approaching, as nearly as may be, to the colour of gold itself. The wire, winding off from a bobbin, twists about the thread, as it spins round; and, by means of curious machinery, too complex to be described here, a number of threads are thus twisted at once, by the turning of one wheel. The principal art consists in so regulating the motion, that the several circumvolutions of the flatted wire on each thread may just touch one another; and form, as it were, one continued covering.

It is said, that, at Milan, there is made a sort of flatted wire, gilt only on one side, which is wound upon the thread, so that only the gilt side appears; and that the preparation of this wire is kept a secret, and has been attempted in other places with little success. There is also a gilt copper wire, made in the same manner as the

gilt silver. Savary observes, that this kind of wire, called false gold, is prepared chiefly at Nuremberg; and that the ordinances of France require it to be spun, for its distinction from the gilt silver, on flaxen or hempen threads. One of our writers takes notice, that the Chinese, instead of flatted gilt wire, use slips of gilt paper, which they both interweave in their stuffs, and twist upon silk threads: this practice he, inconsiderately, proposes as a hint to the British weaver. Whatever be the pretended beauty of the stuffs of this kind of manufacture, it is obvious that they must want durability: the Chinese themselves, according to Du Halde's account, sensible of this imperfection, scarcely use them any otherwise than in tapestries, and such other ornaments as are not intended to be much worn, or exposed to moisture.

Purification of gold, from platina, silver, and base metals.

Aquaregia (nitro-muriatic acid,) in dissolving gold, leaves behind what silver the gold had been mixed with; and certain bodies, added to the solution, separate the gold from it, without being able to separate any metal besides; so that, on this principle, gold may be brought with ease, to its ultimate purity.

The gold, flatted into thin plates, or reduced into grains, is to be put into about thrice its weight of moderately strong aqua-fortis (nitric acid,) and the vessel being set in a gentle heat, a little sea-salt (muriate of soda) is to be added: the dissolution will immediately begin, with a considerable effervescence; and when the action ceases, a little more sea-salt will renew it: the injection of sea-salt is to be continued, by a little at a time, till the whole of the gold appears to be dissolved: the quantity of salt requisite is generally about a third of the aqua-fortis. The clear part of the solution is to be poured off, and the remainder passed through a double filter of paper: the undissolved matter is to be washed two or three times with water in the filter, and this liquor poured to the rest.

For recovering the gold from the solution, Cramer directs two methods;—distilling off the menstruum, and precipitating the gold by mercury. But, in either of these ways, we cannot be certain of having the gold pure: for, though it has been previously cupelled with lead; yet, if it contained any platina, it will retain the whole of the platina after cupellation; and, in some circumstances, it will retain also a little copper: both the platina and copper will dissolve with it in aqua-regia (nitro-muriatic acid;) mercury will precipitate the platina along with the gold; and the abstraction of the menstruum will leave with it both the platina and copper.

The purity of the gold is secured by precipitation with common green vitriol (sulphate of iron.)

The vitriol is to be dissolved in cold water; the solution passed through a filter, and added, in large quantity, to the solution of gold: the quantity of vitriol before its dissolution, should be ten or twelve

times greater than that of the gold. As the precipitate falls slowly, the mixture is to be set by for twenty-four hours, or more: the liquor, then becoming clear, though of a deep colour, is to be poured off; the brownish powder at the bottom, boiled in a little aqua-fortis; then washed with water, and melted, with the addition of a little nitre.

Gold, thus purified, appears to be perfectly fine; a point not obtainable by any other known means that can be practised in the way of business. Nor does the process seem to be so expensive as the imperfect one, by aqua-fortis (or *parting;*) for there, three parts, or more, of silver, being added to one of gold, at least six parts of aqua-fortis are required for dissolving the silver; whereas the gold, in the above process, may be dissolved by half that quantity of the menstruum: great part of the acid may likewise be recovered, by distillation, from the liquor which remains after the gold has fallen.

Kunckel is the first who has taken notice of this precipitation by vitriol: but, having used a vitriol which partook of copper as well as iron, he seems to have thought that the effect depended on the copper; and recommends the bluest and most coppery of the common sorts of vitriol, as the best: accordingly, most of those who have mentioned this process, direct blue vitriol (sulphate of copper,) or vitriol of copper. I have not found that blue vitriol produces the least precipitation in a solution of gold; so that, by this misapprehension, in regard to the nature of the precipitant, Kunckel's discovery was rendered useless, till Brandt happily observed that *green* vitriol produces the effect which had been ascribed to the *blue.*

On the Structure and Habits of the Seal. *By* John Harwood, M. D., F. L. S.

The seal has not attracted that general and popular notice with which its habits and peculiarities deserve to be viewed; throughout the whole extent of animal life, we discern no more beautiful and obvious adaption in structure to those peculiarities and habits than are presented to us in the anatomy of this creature; indeed, these striking appropriations are so numerous, that it becomes difficult to make choice of those most worthy of attention. Externally, the seal is of an elongated form, its neck powerfully muscular and long, and its body formed like that of a fish, broadest across the chest, and gradually tapering to its hinder extremities. For the convenience of swimming, its fore limbs are so short, as to appear destitute of some of the bones and parts found in those of land-quadrupeds: for we only see externally the feet, having their toes provided with sharp claws; but they are so enveloped in broad membranes as not to be readily traced, though capable of free motion. Such a capability, however, only applies to our northern seals, and a few other species; for the eared kinds of the South Seas have their toes almost immoveable, and furnished with flat nails on the fore feet. After

the gradual tapering of the body, which terminates in a short flattened tail, the hinder feet are observed to be furnished with still broader membranes, which in many South Sea species are even extended beyond the ends of the claws, whereby the extent of surface is greatly increased; but in all, aided by the powerful muscles of the spine, these feet act with immense force on the surrounding fluid, and produce an extremely rapid progression. From such external characters, a beautiful connexion is at once observed between the seal and those aquatic animals which surround it, its feet, for example, being intermediate in their structure between the simply webbed ones of the otter and beaver, and the flattened fin-like ones of the manati, the whales, and other cetaceous mammalia which are more exclusively adapted to a watery element. But, in the skeleton of the seal, these gradations and adaptations are still more apparent: though composed of the usual number of bones, the length and flexibility of its neck is of the highest importance in its economy; for, by the slightest inclination of the head, at the end of this long lever, in any direction, while diving, its centre of gravity becomes instantly changed at its will; and thus are its submarine chases, even after the swift salmon, rendered so marvellously successful, that its only mode of escape consists in darting into the shallows. In the general form of the skeleton, seals bear no very distant relation to the weasels, the chest having an unusual extent of motion, by the free articulation of its vertebræ, and, as in those animals, the liver and lungs are each divided into several distinct lobes, that they may glide smoothly over each other, and not oppose the great curvature to which their bodies are liable. On the same principle, their ribs are placed farther asunder than in most others; while the lumbar regions and pelvis, as in all diving animals, are long and narrow, for the attachment of powerful muscles. We now see that the limbs, although so curiously shortened for aquatic operations, possess the same number and arrangement of bones as those of animals whose actions are terrestrial, subject, however, to interesting modifications; for instance, in the fore-feet, the thumb or inner toe is the strongest, and the outer the weakest; but in the hinder feet, to increase the force and extent of membranous surface opposed to the water, the two outer toes are far the longest and strongest.

From such an aquatic conformation, then, it is sufficiently obvious that the movements of the seal on the land are necessarily slow and imperfect: they have been, not unaptly, compared to those of a caterpillar, being chiefly effected by vertical flexures of the spine. Nevertheless, even under these disadvantages, seals defend themselves and their young with their teeth, with great courage and address; thus I recollect having seen a seaman who had been most severely wounded from too daringly attacking a large seal. It was observed by Aristotle, that most animals have their fore teeth sharp, and their inward teeth broad; but that the seal has them all pointed; now, in fact, in the different species of seal, the skull not only affords much variety in its form, but their teeth differ so greatly from each other, that nothing would be more easy, were it by any means de-

sirable, than to substitute new generic names for almost every known species. These differences are well exemplified in various specimens, in which it may be observed, that their front teeth vary in number, having either four or six above, and four below, while their molares vary from sixteen to twenty-four, all of which, in common with their canine teeth, have more or less pointed surfaces.

In the northern seals, the front teeth above have single points; but in the antarctic species, the four middle, upper, and, indeed, lower, front teeth have a double edge, the two outer ones having single points: their molares are either simply conical, like those of the common seal, or are each armed with three points as in the Phoca Grœnlandica.

As sub-aquatic pursuits are those destined for the seal, and as these were liable to be often accompanied with labour and difficulty, it is obvious that they could not be carried on by animals internally organized like those of the land; for the necessity for so frequently rising to the surface to breathe, would have been an effectual impediment to their success. The Creator has, therefore, so modified the mode of circulation in the seal, that this inconvenience has been counteracted, and yet this has not been effected as in the reptiles; for in them the vessels of the heart are so constructed, that the blood can flow freely through them, without going to the lungs, and thereby occasioning a necessity for breathing; nor (which would produce the same effect) do the auricles of the seal communicate, as was formerly thought. On the contrary, in the seal the original type in the construction of the heart is still retained, as also in the walrus and otter, and other aquatic mammalia, with this exception,—that the veins which return the blood to the heart are so much enlarged, that they are capable of changing their office, and becoming reservoirs for receiving and retaining the blood in its progress to the heart. Thus is the right side of the latter, and the lungs, prevented from being oppressed by its superabundance when the creature is under water, and incapable of breathing, and thus is its life sustained. The largest of these venous reservoirs exists in the liver of the seal; but its whole venous system, like that of the walrus and the whales, is very greatly developed. If I may be allowed the expression, like most other aquatic mammalia, the seal appears to be literally gorged with blood; its blood is moreover of an unusually dark colour, being almost black, which property it perhaps acquires by its constant liability to become arrested in its course; and hence, perhaps, the necessity for so much blood in its circulating system—yet the animal heat of the seal is very great.

We shall next briefly advert to some of the *senses* of this animal. Its very large and dark eyes being directed more forwards than in any other aquatic quadruped, added to the round and human appearance of its head, when raised above the surface of the water, doubtless caused it to contribute greatly towards the formation of those ideal marine monsters of which the ancients have favoured us with so many accounts. The eye of the seal is provided with a most perfect membrana nictitans, or winking membrane, the use of which

it is rather difficult to conceive in aquatic animals, except to shield their delicate organs from the too powerful effects of the light, in rapidly rising from the depths to the surface. The pupil of the seal is vertical, like that of the cat; but its soft expressive physiognomy, which more nearly resembles that of the dog than any other quadruped, and is equally expressive of superior intelligence, is not affected by the cat-like form of the pupil, in consequence of the dark colour of the iris. But the greatest peculiarity in the construction of its eye, is a narrow zone, or two zones, as in the Phoca monachus of the Grecian Islands, encircling the globe, of a thinner texture, so much so as to be only one-fourth part of the usual thickness, and more flexible than the rest of the sclerotic coat; and as the straight and oblique muscles of the globe are inserted anteriorly to these flexible zones into a thicker part of the tunic, it is probable that their simultaneous contraction may alter the length of the axis of the eye, and the form of the transparent cornea, by approaching the latter to the retina, and by rendering it more or less convex, and thus better adapt it to the different media in which the creature lives. I think this the more likely, because I have often observed that seals, on first appearing on the surface of the water, appear somewhat bewildered, and do not distinctly discern objects, till their eyes have had time to adapt themselves to the more rare medium to which they are exposed.

The nose of the seal is an organ of more perfect formation than that of any other quadruped. The nostrils are most accurately closed at the entrance by very perfect valves, to prevent the ingress of water when it dives, and, indeed, at all other times, except when it respires. Its breathing also, at all times, occurs at very irregular intervals, often extending to half a minute between each inspiration, but the quantity of air it then receives is very great. As to the internal formation of the nose, it possesses one of the most beautiful structures which the whole class exhibits, especially from the amazing number of the convolutions of those bones on which the infinite ramifications of the olfactory nerves are spread. It has, indeed, been computed by Sir Busic Harwood, that the smelling surface in the nose of a single seal amounts to the enormous extent of two hundred and forty square inches. Now it is no less worthy of remark that something of this curious complication in the organ of smelling likewise obtains in other aquatic animals, and especially the otter, which is a very remarkable circumstance, when we consider that, as before observed, their nostrils, like their ears, are most accurately closed by valves, to prevent the entrance of the water when they dive, and, indeed, at all other times, except during breathing. A question, therefore, naturally arises,—that if, in the pursuit of their prey, or other sub-aquatic actions, they are at all governed by this greatly-developed faculty, in what way are odorous impressions conveyed to the nose?—an inquiry which has, I think, been by no means satisfactorily explained by those who suppose odorous impressions to be conveyed to the nose posteriorly, from the entrance of the throat.

I really suspect, however visionary it may appear, that seals hunt

their prey, or discover its vicinity, by their sense of smelling, when swimming on the surface of the water; for if dogs are very sensible to the scent of a small aquatic fowl on the surface, as we know is the case, why should not the seal of a distant shoal of fishes, sporting, as they constantly do, on the surface, its proper prey, and by means of organs so far more complicated? The same view of the subject of course equally applies to the delicate nasal organs of the otter and the polar bear. Vision, then, I would say, is the sense which governs the seal in its actions beneath—smelling, when upon the surface, and only when out of the water.

The seals of the northern seas are almost entirely destitute of outward ears. The opening into the organ is, like that of the nose, accurately closed by means of a perfect valve. The internal organ of hearing in the seal presents another beautiful intervening gradation in structure between that of the entirely aquatic and the entirely terrestrial quadrupeds: like the latter, the ossicula are attached to the membrana tympani; and, like the true whales, the inferior circumference of the tympanum consists of bone, of unusual thickness and solidity. As to the faculty, I have reason to believe that seals not only hear acutely, but that they are sensibly gratified by musical sounds. When I was most amongst these animals, they much excited our amusement; for, by uttering a whistling sound, we could readily induce them to follow our boats very great distances, when they would continue to raise their heads above the surface, nearer and nearer, and to fix their large eyes steadfastly upon us.

The tongue of the seal is notched at its extremity, unlike that of most other quadrupeds: it is perfectly smooth, yet is doubtless provided with a tolerably acute sense of taste. The predilection of this animal for the salmon is manifest, from the circumstance of that fish tempting it further within the reach of human persecution than any other; hence, I have often seen seals rise to the surface to breathe with salmon in their mouths, at that period of the year, when they lie in such numbers around the mouths of Irish and Scotch rivers, to cut off the retreat of that fish into the sea, after depositing its eggs in fresh water.

The seal's throat is so provided with a valve at its entrance, that the creature has no difficulty in swallowing its prey when under water, without admitting the latter into the stomach.

Of all aquatic genera of animals, the seal appears to be the most widely distributed over the surface of the globe. The common kind, although generally an inhabitant of temperate seas, not only excites much interest by its annual and well-conducted migrations from shore to shore, but often swims northwards into very frigid regions, though seldom higher than the 78th degree of latitude, where it associates with the Phocæ Grœnlandica, cristata, and barbata.

If we regard the antarctic regions, we find them no less the abode and resort of seals than the arctic, as has been lately signally evinced by the hundreds of thousands which were discovered on that vast tract of desert land south of Cape Horn, which has been called South Shetland, and which commences about the 70th degree of lati-

tude, and from whence they have already almost been extirpated by unceasing persecution. From these seas Lord Anson first brought to Europe the immense Phoca Leonina, the Sea Lion, or Sea Elephant, as it is more frequently called, from its possessing a short trunk, and being a creature of no less than twenty feet in length, and the largest species known. Lord Anson was also, I believe, the first who described the poisonous effects of the liver of the South Sea seals; and I have been informed by a Greenland Captain, that he himself, and one or two others, suffered very severely from partaking of the kidney of the common seal. The Phoca leonina, closing the extremity of its short trunk, greatly inflates it when enraged; so likewise, in the North seas, the Phoca cristata, or bladder-nosed seal, has a kind of hood on the head, which it can inflate with air, and with it protect its eyes and nose when attacked: it measures eight feet in length, and is very ferocious. But the largest seal of our own seas, is the Phoca barbata, the species which I think goes by the name of ground seal among the Greenland fishers, and of whose skin the Greenlanders are said to make their thongs for fishing. A specimen of this seal was shot on the north coast of Scotland, which measured twelve feet in length. There is, I believe, one of these preserved on the top of the staircase at the British Museum.

Among the seals which are provided with external ears, of the South Seas, and which have been associated under a new name, are the Phoca jubata and the Phoca ursina. The former being provided with a mane, and measuring fifteen feet long; while the latter is of much smaller size, and is destitute of a mane.

I have been much surprised at the numbers of common seals, from three to five feet in length, which frequent the western coast of Ireland, having often seen there more than twenty reposing together on a rock. Their numbers appear not only to be owing to the unfrequented nature of that interesting part of Great Britain, but certain superstitions of the fishermen induce them, on all possible occasions, to spare their lives. The common seal also abounds on the north shores of Scotland, and the Hebrides; but, of course, from increasing persecution, rapidly decreases in numbers as we proceed south.

The brain of this animal is, I think, doubtless, of greater proportionate magnitude, than in any other quadruped, and not only does it exhibit in its countenance the appearance of sagacity, but its intelligence is in reality far greater than in most land quadrupeds: hence its domestication is rendered much easier than that of other animals, and it is susceptible of more powerful attachment. These circumstances do not excite more interest among the naturalists of the present day, than they did long ago with Aristotle, Ælian, Pliny, and other ancient observers of nature. It is evidently the common seal, to which Aristotle alludes in his description; and his observation, that it is the only quadruped which searches for its food in the sea, would lead us to suppose that he had not an opportunity of acquainting himself with the walrus and sea-otter.

The large seal, which was exhibited some time ago at Exeter Change, appeared to me to understand the language of its keeper as

perfectly as the most faithful dog. When he entered at one end of its long apartment, it raised its body from the water, in which it was injudiciously too constantly kept, supporting itself erect against the bars of its enclosure, and wheresoever he moved, keeping its large dark eyes steadfastly fixed upon him. When desired to make obeisance to visiters, it quickly threw itself on one side, and struck the opposite one several times in quick succession with its fore foot, producing a loud noise. The young seal, again, which was kept on board the Alexander, in one of the northern expeditions, became so much attached to its new mode of life, that after being thrown into the sea, and it had become tired of swimming at liberty, it regularly returned to the side of the boat, to be retaken on board. Such examples might be greatly multiplied, but these are amply sufficient for our purpose; and I cannot help stating, that aware of this disposition to become familiar, this participation in the good qualities of the dog, it is astonishing that mankind have not chosen this intelligent and finely-organized quadruped, for aquatic services scarcely less important than some of those in which the dog is employed, on the surface of the land.

The seal is among the few polygamous quadrupeds; and, like the rest, the males, during the period of intercourse, enter into violent conflicts. Two young ones are generally produced at a time in the autumn. They are brought forth in caverns, extending from the sea above high-water mark, and here they remain suckling during several weeks, before they venture into the water. When they become fatigued by swimming, we are assured that the parent supports them on her back.

The voice of the seal consists of a kind of bleating, whence doubtless has the common seal obtained the name of the sea-calf, the Phoca vitulina: the voice is, however, liable to great variation, especially during changes in the state of the atmosphere, when they become extremely clamorous. Spending their nights on the surfaces of rocks, or upon the shore, it is during their very sound repose in these situations that they are approached and destroyed with sticks; and when thus alarmed, they tumble their young ones before them into the sea, and are themselves often sacrificed in the very act. But the means by which they are captured in by far the greatest numbers, is by cutting off their retreat to the sea at low water, when, in apparent security, they lie in large herds within caverns: firearms, in these cases, are never had recourse to, as a comparatively slight blow by a stick on the head, or nose, is sufficient to destroy life: this arises either from the thin and fragile nature of the bones of the skull of the seal, or the great and immediate nervous communication which exists between its nose and brain. Among more uncivilized nations, its mode of destruction is far more tedious and less efficient. Thus, for instance, the Esquimaux, after long watching, first strikes a seal with his barbed spear, to which a line is attached, having at its extremity a large floating buoy, composed of the inflated skin of another seal; thus entangled and opposed in all its

efforts to retreat far beneath, as often as it rises to breathe, it receives a fresh wound from the unerring spear of its destroyer.

We now proceed to say a few words on the uses to which this animal is applied, when deprived of life, by the more civilized nations of mankind. As to the benefits which the inhabitants of frigid regions derive from it, they are far too numerous and diversified to be particularized, as they supply them with almost all the conveniences of life. We, on the contrary, so persecute this animal, as to destroy hundreds of thousands annually, for the sake of the pure and transparent oil with which it abounds; 2ndly, for its tanned skin, which is appropriated to various purposes by different modes of preparation; and, 3dly, we pursue it for its close and dense attire. In the common seal, the hair of the adult is of one uniform kind, so thickly arranged and imbued with oil, as to effectually resist the action of the water; while, on the contrary, in the antarctic seals the hair is of two kinds: the longest, like that of the northern seals; the other, a delicate, soft fur, growing between the roots of the former, close to the surface of the skin, and not seen externally; and this beautiful fur constitutes an article of very increasing importance in commerce; but not only does the clothing of the seal vary materially in colour, fineness, and commercial estimation, in the different species, but not less so in reference to the age of the animal. The young of most kinds are usually of a very light colour, or entirely white, and are altogether destitute of true hair, having this substituted by a long and particularly soft fur. [*Quarterly Journal.*

On Retaining Water in Rocks for Summer Use. *By* Mr. William Smith, *Engineer*, M. Y. P. S.*

As practical applications of knowledge acquired from geology, in relation to the comforts and conveniences of man in a most essential article of life, must be considered matter of importance, I hope to be excused for troubling the Society with a detailed account of what I may call a Geological Reservoir of Water made in the hills near Scarborough, in the driest summer this country has experienced for sixty years.

We know, from the annual variation of springs, that rocks hold a much greater quantity of water in winter than in summer; and we further know, that in wet seasons rocks hold periodically much more than their annual average quantity both in winter and summer: and hence the question as to the possibility of retaining water in rocks for summer use, is decided by the annual and periodical operations of nature.

For the means of altering or improving some of these natural operations, so as to render the irregular supply of water which falls upon the earth more convenient to the general purposes of man, we

* Read to the Yorkshire Philosophical Society March 1827, and communicated by the Rev. W. V. Vernon, Pres. Y. P. S.

must resort to geology;—to find what stratum is fitting for the object, and what site in the range thereof; what the rock lies upon; what stratum or diluvium covers it, and the dip, rises, and troughs or undulations in the strata.

I have for many years entertained notions of the practicability of making use of rocks as subterraneous reservoirs of water, in some cases extensive enough for the use of canals; and once, in a Report on Springs, suggested such a plan to one of our canal companies. But for the use of towns and dwelling-houses, many situations may be found where the joints of a rock are capacious enough for penning up winter water therein, for use in even the driest summers; as many springs which then fail, produce a superabundant quantity in winter.

This was the state of the first springs anciently taken from the adjacent hills, to supply the town of Scarborough; which supply has been from time to time increased and improved at the expense of the Corporation. Within a few years new pipes have been laid at a great expense.

Still, however, in the summer months, when there was much company in the place, water was deficient; and the commissioners for improving the town undertook to search for more water on the hill sides about a mile and a half distant.

In the month of May last a small quantity was found to issue from a bore-hole made several years since for draining the land. On cutting an open channel up to this, the discharge increased, and at the depth of nine or ten feet, amounted to twenty-four hogsheads per hour. This encouraged them to proceed; and the channel, under my direction, was deepened four feet, when the discharge became for some time fifty or sixty hogsheads per hour.

Suspecting from an intermediate and subsequent diminution that we had drawn off a confined stock of water, and that the regular run of the spring at the end of a dry summer might not be found sufficient, I suggested the propriety of damming up the produce of this spring for summer use, as the previous supply was more than sufficient for the town in winter.

The circumstances were favourable for the purpose, as there was no other known issue of water from the rock in that hill, which is about a mile long, narrow on the top, and insulated in all the upper part of its stratification. The same rock is not opened or known any where else on these hill sides, but in a deep valley which separates the insular hill, from the main and higher hill of Falsgrave Moor. In the upper end of that valley a spring was opened several years since in the same kind of rock, and was brought with a declivity of thirty or forty feet round the south end of the insulated hill, near to, and high enough to run into the opening made to the new spring. This was sufficient to prove the general rise of the rock westerly in the base of the insular hill, and beneath an isthmus connected with the main ridge of Falsgrave Moor and Seamer Beacon. The rock in which the spring was found, is a yellowish fine-grained crumbly sandstone, in thick beds, with open irony joints,

the same as in the cliff south of Scarborough Spa. From the quantity of carbonaceous matter in it, it is here called "coaty grit." This sandstone, with its overlying and alternating clays, is analogous in position to the clay and sand and sandstone between the cornbrash and great oolite rocks. At the depth of ten feet the rock was found covered with regular clay about four feet thick; on this a mark of coal, and a thin bed of hard stone full of imperfect vegetable impressions; and up to the surface a very tenacious *slidden* clay. The rock was found, by boring through it, to be ten feet thick, lying on clay. The channel excavated up to the spring about thirty or forty yards long, and fifteen feet, at the upper end, was entirely in a very tenacious clay, partly diluvial, with a few rounded stones in it deeply covered by slidden clay. Within four feet of the edge of the rock, lay gravel (deeply covered also with slidden clay,) consisting of large and small boulders of whinstone, granite, mountain limestone, &c., which gravel, between the clay and the face of the rock, tapered downward "to nothing" in the bottom of the excavation.

About two yards within the edge of the rock (which was nearly as upright as a wall,) a basin six feet in diameter and four feet deep was excavated, to receive the water flowing from the joints of the rock. Cast-iron pipes branching from the main line of pipes were laid up to this basin, to receive the regular flow of the spring, which before the end of summer was reduced to less than six hogsheads per hour. The clay channel, in the bottom of which the pipes were laid, was refilled with clay and puddled, so that no water could pass from the rock but through the pipes. The end of the last pipe was closed, and a vertical aperture made for receiving the run of the spring. No further contrivance was required for stopping the water and damming it up in the rock, than an open vertical pipe, ground to fit tight into the horizontal pipe; and this to the height of four feet was done by pieces of pipe, each a foot in length, tight fitting one into another, for the convenience of wholly or partially damming or drawing off the stored water, as occasion may require; the water being allowed to run in at the top of the pipe.

After the rainy days in the beginning of November last, these short pieces of pipe were put in, one after another, and found to dam up the water in the joints of the rock to the height of four feet, which, from the quantity wasted last summer during the progress of the works, was calculated to contain five thousand hogsheads. The vertical pipe being since closed at top, (and lately also the main iron pipe,) the whole of the water from those parts becomes forced into the cavities of the rock, and now stands fourteen feet deep at the spring, or ten feet higher than we calculated upon penning it; so that the subterraneous reservoir may contain twelve thousand or fifteen thousand hogsheads of water. This will be ascertained in the summer as it is drawn down from time to time into the new arched reservoir in the town. This reservoir, formed of a brick cylinder eighteen feet deep, sunk in the ground, and covered by a dome forty feet span and twenty feet high, surrounded by a strong bank of earth, is calculated to contain four thousand hogsheads. [*Phil. Mag.*

THE ALBANY INSTITUTE.

It is a most cheering prospect to the man of science to witness the frequent establishment of institutions, formed for the investigation of natural history, and the concurrent pursuit of intellectual wealth in the various departments of knowledge. Among the number of such societies recently formed, is the Albany Institute, which has issued the first number of its Transactions. The advertisement informs us that, "The Albany Institute is composed of two Societies, which for various periods of time have existed in this city—*The Society for the Promotion of Useful Arts in the State of New York*, and the *Albany Lyceum of Natural History*. Circumstances, not necessary to be explained, led to a union of effort and property between their members and other citizens, and, as a necessary consequence, to an enlargement of the objects of investigation. The present title of the Association was adopted, under the idea that it would comprise the pursuit, both of science and literature, in their most extensive sense.

"It has been deemed adviseable to commence the publication of some of the papers read before the Society. The members do not flatter themselves that they will greatly add to the general stock of knowledge—they may hope, however, that their efforts will tend to disseminate a taste for it."

To the Editor, the intelligence of the progress of science in this ancient city, has been peculiarly pleasing, as it is associated in his mind with many cherished recollections; his medical studies were pursued there, his first essays as a public lecturer were made there, and were favourably received and liberally supported, and his most intimate and dearest friendships were there contracted. At the period alluded to, there were no public institutions for the pursuit of science; several have been since formed, and he recognises among the names of the officers of the Institute, a number who were formerly known to him, either as veterans, or as youthful volunteers, in the corps of "Lovers of Knowledge."

The following are the contents of the first number of the Transactions.

1. Table of the Variations of the Magnetic Needle, at Boston, Falmouth, and Penobscot, from 1672 to 1800; furnished by the late General Schuyler, to Simeon De Witt, Surveyor General.

2. On the Luminous Appearance of the Ocean. By Lieut. Thomas R. Ingalls.

3. On the Geographical Botany of the United States. By Lewis G. Beck, M. D.

4. On some Modifications of the Electro-Magnetic Apparatus, (with a plate.) By Joseph Henry.

The observations of the second paper, which we extract, are in harmony with the views of another on the same subject, contained in our present number.

On the Luminous Appearance of the Ocean. By Lieut. Thomas R. Ingalls, *U. S. Army. Read before the Albany Institute, March* 26, 1828.

This beautiful phenomenon, which once bore the poetical title of "phosphorescence of the ocean," has more recently, I believe, rested between two solutions: that it is caused by animalculæ, or by the ovula of fishes. A writer in a recent foreign periodical, inclines to the former opinion—viz. that the luminous appearance of the ocean is caused by animalculæ. As I have been for some time inclined to the opposite view of this subject, I am induced to submit an account of some observations made a few years since in the humble pursuit of science.

In the practice of sea bathing at night, in a southern latitude, I had of course noticed and admired the beautiful sparkling of the water when agitated or resisted—but the myriads of bodies of whatsoever sort which emitted these corruscations, were alike invisible and impalpable. On one occasion, however, I struck my arm against a small, soft, mass, which immediately emitted a flash of two or three inches in diameter. But the mass eluded my attempts to secure it, as it was invisible the moment it parted from its accidental contact with my arm. This occurred several times afterwards, and I began to think I perceived a sensation of warmth whenever I struck one of these bodies, though aware how liable I was to be deceived by the almost irresistible association of light and heat, in the mind. A very large one ultimately convinced me I was not deceived; the sensation being, on this occasion, perfectly distinct—grateful—and continuing for a minute or two after the touch.

The masses of marine ovula, left by the tide to heat and hatch on the beach, I had long before observed through the whole process of vivification. First, a transparent mass of jelly—next marked by a white opaque speck, a little distant from the centre—third, this spot fringed with a red border, of the colour of arterial blood, next, a kind of irregular pulsation, accompanied by the development of certain white contractile fibres, and the extension of several large red lines, in radial directions from the focal opaque speck—the appearance of a black speck, ultimately a defined head—and finally, I have seen the rising tide shake out from the mass, the perfect animal, apparently in the full possession of life; certainly exercising the important function of apprehension of danger.

The identity of this ovulum, with the luminous bodies I encountered in the water, appear probable, from their size, consistency, and their abounding in the same regions. It was soon after ascertained: for on a night when the sea was somewhat agitated, I observed the same corruscations in the waves breaking on the beach, and succeeded in obtaining several of the illuminating bodies, by the light of their own flashes. They appeared, as I expected, identical.

When examined by candle-light, to overcome the glare of their

brilliancy, and at the same time to observe their action more clearly, the power of illumination appeared to reside in a similar focal point, to that described as the place of the first phenomena of vivification; and the flashes which could be procured by irritating the mass with the end of a pencil, diverged from this point, in lines similar in magnitude and direction, to the large red ones mentioned in that process. I regret that it did not occur to me, to electrically insulate one of these bodies, and endeavour to obtain shocks; but I was too much occupied with the question above stated, to avail myself of the means in my hands, of making some interesting experiments on the theory of life.

The existence of those large corruscating bodies in the ocean has been before recorded, and there is, I believe, a paper on this subject, by Dr. Mitchill, published ten or twelve years ago; but it is thought some parts of the observations are not on record, and they are now submitted in the hope of being, in some small degree, useful—or pardoned, if superfluous.

The conclusions I formed on this subject, were, that in this instance a luminous appearance in the ocean was produced by marine ovula; and by a rule of philosophizing, all such appearances not proved to proceed from another source, and not inconsistent with this cause, are fairly assignable to the same origin.

Watervliet Arsenal.

On the Combination of a Practical with a Liberal course of Education. By W. R. Johnson, *Principal of the High School of the Franklin Institute.*

No. III.

The *course of study*, given in the preceding number, is not offered as a *complete* exemplification of *practical* and *liberal* education, united. The combination might, however, be easily extended to the courses pursued at our colleges and universities. No good reason can be assigned why the higher branches of mathematics, logic, ethics, or metaphysics, should not be pursued simultaneously with those sciences and arts, which pertain to the active duties of life.

By referring to the course already delineated, the reader will perceive that it consists of four important classes of studies, each of which has generally been confined to a separate school. The first class includes *English* branches; the second, *classical* studies; the third, *modern languages*, and the fourth, *mathematics* and the *practical sciences*.

Whatever be the destination of the student, whether for active life, or for a literary and professional career; whether he shall finish his studies in this institution, or be removed to a university, the importance of his *English* course will, under every contingency, remain the same. A correct elocution, a degree of facility both in oral and written composition, a knowledge of the great outlines of

ancient and modern history, some acquaintance with the principles of domestic and political economy, and a clear understanding of the provisions of those constitutions of government under which we live: all these, in addition to the more common branches of English education, ought to be acquired by every youth who aims at success and usefulness in his future pursuits.

Those whose views extend to a more enlarged course of study, will, in addition to the *usual* preparation for college, find themselves *actually prepared* for a collegiate education, by having learned the *elements* of most of those branches which they are subsequently to pursue. *Preparation for college* often consists in a meagre, or merely passable, knowledge of Greek and Latin, a little geography, less arithmetic, and scarcely any other attainment. Both precept and example have concurred to inspire a great contempt in the minds of students, while at school, for every other species of knowledge. It is unnecessary to point out the numerous impediments, which a scholar thus slenderly furnished, must encounter in the prosecution of an extended course of liberal education. If the institution to which he is admitted, deserve the name of *college* or *university*, it will immediately demand of him the use of powers and attainments with which he is not provided; and thus the business of his school remains to be prosecuted at the university, which, consequently, is reduced to the rank and condition of a mere grammar-school. This degradation of our higher institutions, in consequence of the defects of our classical schools, has, among other causes, tended to bring the honours, bestowed by the former, into contempt. Men who have received degrees at the *real* universities of Europe, deride the idea of being *re-doctorated* at imaginary ones in America.

Those who understood its nature and influence, have seldom objected to a *classical* course, on any other ground than that of the vast expense of time and money which it involved, and the exclusion of other useful objects, which, on the old system of teaching, it necessarily implied. On the High School system, both these grounds of objection are removed. The expense, to those who study ancient languages, is no greater than to those who limit themselves to English branches; and by fixing a time for every thing, and causing every thing to *be done in its time*, no exclusion of useful objects is required. The scholar who is destined to be a man of business, is enabled to acquire all the classical learning which is necessary to a comprehension of the derivations and construction of his own language. The allusions to ancient customs and manners, which abound through our English literature, will, likewise, be sufficiently obvious to his understanding; and a taste for correct and chastened style in thought and expression, will have been acquired. This amount of influence from classical learning, is desirable for every citizen in an enlightened and civilized community.

The course of *modern languages*, is of equal importance, whether we regard it as a part of a *practical*, or of a *liberal*, education. In all our commercial cities, the man who cannot use the French language, will find his sphere of profitable operations essentially limited;

and the vast number of persons, inhabiting every part of our country, to whom this language is *vernacular*, will furnish innumerable opportunities of profiting by a familiar acquaintance with this universal medium of international communication.

The obvious utility of the Spanish, in facilitating every sort of intercourse with the southern parts of our continent, renders any discussion of its merits unnecessary.

In some parts of our country, the *German* is even more necessary, for success in business, than either of the two languages above mentioned; thousands of our citizens speak no other: of these many who possess a partial knowledge of the English, still, naturally, give a decided preference to their own strong and expressive dialect.

If we regard the study of these several languages merely as part of a liberal education, their value is in no degree diminished. The treasures of literature which they unlock, are as valuable and delightful as those unfolded by any language of antiquity. Nor can we excuse our ignorance of these tongues, by alleging that all the taste and beauty of foreign authors, have, through the medium of translations and imitations, been transfused into our own literature. Every competent judge of the matter, knows the allegation to be unfounded. It is surprising, that, at many of our colleges, these languages are rather tolerated than encouraged. When those institutions shall have completely divested themselves of a monastic character, we may hope to find modern languages among the essential requisites for graduation.

But whatever merit may be claimed for the three divisions of our course already enumerated, the *fourth* is not less important, less practical, or less adapted to the age of the pupils for whom it is intended, than either of the former. The several branches of mathematics, practical mechanics, natural philosophy, elementary chemistry, the philosophy of natural history, with drawing and perspective, all appeal, more or less directly, to the *senses*, and consequently excite the interest of youth more forcibly than subjects in which laws and relations are to be comprehended only by means of abstract and general expressions. Experience justifies this inference respecting their adaptation to the capacities of early youth.

Scarcely one of the numerous branches of industry in which our citizens now engage, can be successfully prosecuted for a single day, without involving the use of some one of these departments of practical science. Hence their utility is unquestionable. And every professor in our colleges, must doubtless have felt that the advantages to his hearers, and the pleasure to himself, would both be greatly enhanced, if the former could bring to his lectures some just and accurate elementary ideas, on the subject about which he was to address them. What has been said above, respecting the inconveniences occasioned to higher institutions by the want of proper acquaintance with English studies, applies with equal force to these sciences. Our colleges are degraded, because their professors are compelled to dwell perpetually upon the elements of their respective subjects.

In arranging this *course*, it was a primary object to produce an

easy and natural transition from one branch to another, in each of the great departments; to introduce nothing as a merely ornamental accomplishment; and to cause the student to behold his interest blended with his duty. It is not predicated upon the maxim which has sometimes been broadly proclaimed,—that one branch of study is as good as another, provided it cost the scholar the same kind and amount of toil, to perform what is required by his teacher. It is founded upon the belief, that with respect to intellectual education, that is the best, which, with the greatest number of theoretical and practical truths, furnishes the highest improvement of the faculties, and affords the most enduring mental pleasures.

No ordinary share of talents and industry must be possessed by the scholar who would, within the time allotted, accomplish all that is contained in the course above described. Still, however, those who are accustomed only to that sort of application, which dreams away time, or pores with excess of disgust over one or two tedious volumes, can scarcely imagine the result of a system which by varying the occupations, multiplies the energies of the mind, and by riveting the attention to its immediate object, makes permanent acquisitions at every step.

The chemist knows, that when water is saturated with one salt, it will still dissolve a large portion of another of a different kind; and when saturated with this also, that a third may be added without *precipitating* either of the former. The youthful mind has similar affinities for *varied* pursuits, and analogous points of saturation. Much of the profitless labour of teachers consists in attempts to super-saturate it, with some *one* ingredient, to the exclusion of others which it would eagerly receive.

An Essay on Calico Printing.

[Extracted from Parke's Chemical Essays.]

As the whole of this ingenious business, as it is now conducted, depends upon the proper application of a few compounds called mordants, it will be necessary, in the first place, to explain their nature and uses. In doing this, one or two preliminary remarks will assist us.

The colouring substances chiefly employed in this art, are divided into two classes, viz. *substantive* and *adjective*. A SUBSTANTIVE colour is one which is capable, of itself, of producing a permanent dye; such is the juice of the buccinum,* used by the ancients for producing the imperial purple; such are also the woad and indigo†

* It has been proposed to employ this valuable permanent colour for pencilling on fine muslins. I believe it might readily be procured in sufficient quantities, and would prove an important addition to the resources of the British calico-printer.

† Dr. Bancroft tells us, that the first mention of indigo, as known in England, is in the Act of the 23d of Queen Elizabeth, chap. 9, where it is called *Ancle*, or *Blue Inde.* Bancroft *On Permanent Colours*, page 138.

employed by the moderns for producing a permanent blue; and we may add the metallic solutions, particularly those of iron, cobalt, gold, platinum, and silver, which give various colours according to the processes by which they are prepared.

By ADJECTIVE colours are meant all those which are incapable of giving permanent dyes without the aid of certain intermedia, which form, as it were, a bond of union between them and the substances intended to be dyed.

These intermedia are what are known by the term MORDANTS, and they are used for this purpose in very considerable quantities by the calico-printer of the present day.

"The ancient Gauſs and Britons were not ignorant of the method of imparting various dyes by means of substantive colours; we have even direct evidence that they excelled in some branches of this art, and possessed valuable secrets in it that were unknown to other nations. Several of the herbs which the Gauls and Britons used in dying are occasionally mentioned by Pliny, in different places; but the herb which they chiefly used for this purpose was the *glastum* or *woad*, the isatis of Linnæus; and they seem to have been led to the discovery of its valuable properties in dying cloth, from the former use of it in painting and staining their bodies."*

Several expedients were also employed by the ancients to produce fast, or, more properly, permanent colours, by means of mordants, as appears from the testimony of Aristotle and Pliny. The chief articles in use at present in Great Britain, are the acetate of iron, the acetate of alumina, and the various solutions of tin, all of which should be very carefully and correctly prepared.

When piece-goods are designed to be dyed of one uniform adjective colour, they are first immersed in a solution of one of these mordants, and are then hung up to dry, and to absorb the oxygen of the atmosphere. When sufficiently exposed to the air, they are washed or dunged,† to remove the superfluous mordant; that is to say, that part of it which is not chemically combined with the cloth; and the pieces are then submitted to a bath of that particular kind of colouring matter which is to be imparted to them.

It may here be remarked, that if a sufficient number of colouring substances should ever be discovered, that have no affinity for any thing but the chemical mordants, the business of calico-printing would be rendered much more easy and simple than it is at present.

Whenever it is meant that a colour should be partially inserted, the mordant is applied to those particular parts only; so that, when

* Henry's *History of Great Britain*, 8vo. vol. ii. page 128.—Pliny's *Natural History*, books 16, 18, 21, and 22.

† The dung of the cow is used in such large quantities by the calico-printer, that it has become an article of great expense. The proportion that is employed is usually about one bushel to one hundred gallons of water, though frequently a larger proportion would be more effectual. The brightness of the colours, and the purity of the whites, are always dependant upon the quantity of the dung employed.

the piece is immersed in the colouring bath, no other place will receive the permanent stain. For though the whole surface of the cloth will be coloured, yet having in itself no affinity with the vegetable with which the decoction is impregnated, the whole of the colouring matter will be easily removed by exposure to the air, and the ground of the piece restored to its original whiteness; while those parts to which the mordant was applied, will retain and fix the colours in a way which will be more fully explained hereafter.

Formerly, all calico-printers were bleachers; but in the neighbourhood of London these are separate and distinct trades, and the printer either purchases bleached goods for printing on his own private account, or receives the cloth from his customers in a white state; and, when printed, he returns the identical pieces, and is paid so much per yard, according to the number of colours, for printing them.

Chloride or oxymuriate of lime is the agent generally employed in bleaching; but it appears to me that some other article might be introduced with advantage. For, as the goods are washed in diluted sulphuric acid when they are taken from the oxymuriate of lime, a sulphate of lime is always formed, which becomes fixed in the fabric, and, acting as a mordant when the pieces come into the madder copper, occasions an indelible stain, which in very fine goods, often impairs their beauty. If oxymuriate of soda were employed, the sulphuric acid would form a soluble salt with the soda, easily removable by washing. The expense of this article, will, however, be always an objection to its use, except for rich and valuable prints.

I am aware that some printers, who are more anxious about the quantity, than the quality of the work they perform, would deride this caution, and say they can obviate the difficulty by washing the goods *before* they are submitted to the sulphuric acid. But I am so confident of the extreme difficulty there is, even in this way, of removing the oxymuriate of lime, that I know the inconveniences above mentioned will very often occur, almost inevitably.

In my opinion every printer should bleach his own goods, for it is impossible always to rely with confidence on the care of those who bleach for hire; and every printer knows that good bleaching is absolutely a necessary preliminary in the production of good printing. Indeed, this is now pretty generally acknowledged in the north of England; for most of the opulent houses in Lancashire and in Scotland, who produce fine work, are bleachers as well as printers.

No people have taken more pains to excel in bleaching than the Irish, and their credit is established accordingly. The German linen is, I believe, generally better than theirs; but the Irish has always the preference in foreign markets, owing to the superiority of the Irish in bleaching and finishing.

By whatever means the bleaching is performed, the printer commences his part of the business in the following manner.

The goods are first DRESSED by singing off the whole of the nap

which is attached to them. This is effected by the following contrivance: Ten pieces are generally wired together, and wound upon a roller, from whence they are passed over a hot iron, nearly in the form of half a cylinder, and received upon another roller; from thence they are returned to the iron, which is still kept red, or nearly at a white heat. The use of repeating this process is to remove the nap more effectually than it would be done by passing it only once over.

The next operation is that of STEEPING, which consists merely in soaking the pieces for twenty-four hours in a vessel of weak alkaline lie, at a temperature of about 100°. These operations of singing and steeping are going on at one and the same time, which effectually prevents any accident that might otherwise arise from the effects of the hot iron.

The goods are then boiled or else bowked in a solution of potash; (some workmen prefer to have this alkali in a pure caustic state;) they are then well cleansed, by thorough washing in wash wheels, or in stocks, to ensure their being entirely divested of the alkali. The intention of thus treating them with potash, is to remove any grease or impurity that may be attached to them, which would otherwise endanger the evenness and uniformity of the colours. This process is called ASHING.

By some observant calico-printers it has been imagined, that the rendering the lie caustic is apt to impair the texture of the cloth; and I doubt not but that this has often been the case. Under the eye of the master, however, I am sure it might be employed with advantage and safety. With advantage, because *mild* alkali has but a slight affinity for the grease; whereas *caustic* alkali forms a real soap with any oleaginous matter, and then the compound is readily soluble in water. And though the alkali be made perfectly caustic, if the solution be sufficiently diluted, it may be used with perfect safety.

It may be remarked, that in weaving calicoes the workman generally greases the reeds, in order to make them move easier. Whenever this grease is in the cloth, it becomes fixed by the operation of singing; and if it be not taken out before bleaching, it will not come out afterwards by the usual process of ashing and souring; for, when the pieces are submitted to a blue vat to be dyed of a uniform self-colour, all those greasy places will be found to have taken the dye in a very imperfect manner. Tallow is also employed in dressing the warp, and this has a baneful effect on all goods which are designed for printing.

If, however, the calico-manufacturers themselves would make a point of preparing the oleaginous matter for the weavers, and would furnish them with nothing but pure VEGETABLE OILS, such as those of rape, linseed, &c. I think it very likely that these inconveniences would not occur; because the stain from *vegetable*, is not so indelible as that from *animal* oil.

This defect in the operation of the pale blue dipping is often attended with very serious consequences, so that I know of no subject

which better deserves the patient investigation of the calico-printer. I have seen a large number of pieces of printed calicoes which had all taken a solution of iron so as to form an extremely good black; also the acetate of alumina, which had formed, with the madder, a beautiful red; likewise the citric acid, which produced a perfect resist—and yet when these goods came into the blue vat, certain parts of the pattern intended for blue, still remained quite white, the indigo having had no action whatever on those parts; a circumstance which is sufficient of itself to spoil the goods, and render the whole expense of printing the other colours, totally lost.

To cleanse such goods previously to their being printed, various expedients have been adopted, but I apprehend nothing but a solution of caustic alkali can be depended upon. To prove the effect of any method which may be tried, it is a good way to run the pieces through water, and then to pass them from the water so gradually over a roller, as to give the superintendent an opportunity of examining every inch of the surface; and if any part remains greasy, it will be seen at once, for that part will continue dry, while all the rest of the cloth is wet.

There is another way in which the goodness of bleaching might be proved. Let a few of the suspected pieces be run once or twice through a madder-copper, at the temperature of about 180°. This will inevitably mark any part that may be imperfectly bleached; whereas, if the operation has been properly performed, they will come out so little stained, that an intelligent workman, who has been used to a madder copper, will, at once, be satisfied that they contain no impurity that can form a permanent mordant.

The next process in calico-printing is one with diluted sulphuric acid. A quantity of soft water having been poured into a leaden vessel, oil of vitriol is gradually added to it, in the proportion of about twenty pounds of oil of vitriol to every hundred gallons of water, which by weight is in the proportion of about one to forty.

When this mixture has been well stirred, it is ready for use. Sometimes it is employed in this state, at others it is heated to 90° or upwards of Fahrenheit, according to the nature of the work to be done, and the goods are immersed in it. They are not suffered to lie in this acidulous liquor, but are wound by means of a winch over a wooden cylinder, that every part of the cloth may be successively immersed in the fluid, and every part exposed alternately to the action of the atmosphere.

This operation is generally continued for about twenty minutes, and is designed to remove any iron-moulds or other stains which the cloth may have acquired. It has also the effect of neutralizing any portion of potash that may have been left in contact with the cloth. The process is called SOURING.

After this operation it is necessary to wash the goods thoroughly, that no part of the acid may be left in them, to injure their texture; and this is best effected by means of the wash-wheel. The calicoes are then to be regularly and thoroughly dried, which finishes these preliminary operations, known in the trade by the term PREPARATION;

so that those cloths which have passed through these manipulations are said to have undergone a preparation.

Besides the uses already mentioned, there is another advantage attending these processes, viz. that the cloth which has undergone this preparation will bleach sooner, the colours will be brighter, and the whites more delicate, than they would have been had they not gone through these previous operations.

The next process is that of CALENDERING. Here the goods are passed through a set of rollers, which gives them a gloss, and the appearance of their having been ironed. They are now fit for printing. But for copper-plate printing, or cylinder work, the process of calendering is omitted.

In printing fast colours, the artist usually proceeds in this way: He lays the piece of calico, which has been already smoothed by calendering, upon a strong thick table, which is previously covered with a woollen cloth. He then proceeds to apply one or more mordants, as the case may require, for fixing the intended colours. These mordants are applied by means of wooden blocks, with the patterns formed upon them. These blocks were formerly chosen of holly, or other hard wood, and the cutting them was a separate branch of the business. Of late years, however, a considerable improvement has been made in this department, by the introduction of brass or copper; that is, the pattern, instead of being actually cut in the wood, is now formed by means of slender pieces of one of those metals being firmly fixed to the block, so as to produce the pattern intended. This alteration was occasioned by the perishable nature of wood, on account of which every printer has incurred great and unnecessary expense. The pattern when thus formed with copper, is not only more lasting, but it has also the advantage of giving greater sharpness and beauty to the impression.

When it was customary to use wooden blocks, the patterns were not enchased in the wood, but the wood was cut away in such a manner as to leave the pattern in relief. It will be obvious that this must always be the case in *block*-printing.

When the mordant is ready, it is mixed up either with flour-paste, or with a thick aqueous solution of gum arabic, gum senegal, or gum tragacanth.

Flour is an article of considerable consumption with the printers for making paste. Some houses buy twenty barrels of American flour at once. Should it be musty or sour from keeping, it is of little consequence for their use; but they are careful to buy none but such as has been made with sound wheat, for if unsound, it will be of no value for their purposes. Gum tragacanth is much dearer than the other gums; but notwithstanding this, it must be had for some styles of work, as no other will answer for any of those colours or mordants which are prepared with nitrous acid. A solution of gum senegal would be coagulated in an instant by any of those preparations. Of late years an article called British gum has also been much in use for the same purpose; so much so that the making of it has become a distinct and considerable trade. It is merely

common STARCH calcined till it assumes a cinnamon brown colour, and then pulverized and passed through sieves of various degrees of fineness.

When the colour has been properly mixed with flour paste, or with a solution of either of the gums above mentioned, it is then spread upon a piece of superfine woollen cloth, strained tight upon a hoop.

This is placed within another hoop, covered either with sheep-skin or oil-cloth. These hoops are both so broad as to give to each of them the appearance of a tambarine. That which is covered with the woollen cloth is called a *sieve*, the other a *case*. The sieve within its case is now placed in a small tub of gum-water, and is ready for use.

When the apparatus is thus prepared, the mordant is applied by a brush to the surface of the sieve. This is called TEERING.

It should have been remarked, that when a colourless mordant, like the acetate of alumina, is employed, the workman generally mixes a little of the decoction of Brazil wood, or of any other fugitive dye with it. This is called SIGHTENING; and is for the purpose of making the pattern more obvious to the workman, that he may see its progress, and the efficacy of the materials, as he proceeds in printing.

[TO BE CONTINUED.]

Prognostics of the Weather.

[Abridged from FORSTER's *Encyclopædia of Natural Phenomena.*]

[CONCLUDED FROM PAGE 107.]

Kites made of paper, such as are usually flown by boys, may be converted into useful prognostics of the wind. When several of them are let up together, the higher ones being successively tied to the backsticks of those below them, they will ascend to a vast height. We have known the upper kite in these cases ascend to above one thousand feet high. When the upper one gets a direction different from the lower one, the wind will frequently be found to get into the quarter indicated by the upper kite. This law respecting winds is more strikingly manifested by means of small air-balloons, whose varying directions, as they ascend, portend the successive changes of wind, which often take place first in the higher regions of the air. See *Balloon*, *Cloud*, *Current*, and *Wind*.

When by the motion of kites we perceive that the wind vibrates or shifts its direction, we may be sure the weather will be squally. There is also a kind of bobbing motion sometimes imparted to kites by the wind in variable weather. The kite seems to nod backward and forward, thereby pulling forward the arm of the person who holds it, by successive jerks.

Lamps, from the manner in which they burn, forbode weather.

Before rain they burn less bright, the flame snaps and crackles, and a sort of fungous excrescence grows from the wicks.

Larks, when they fly high, and remain singing a long while in the air, forbode fine weather.

Magpies, in windy weather, fly often in small flocks of three or four together, uttering a harsh cry.

March Dust and *May Sun*, both of which imply a fine dry spring, are said to be particularly good omens for the husbandman. An adage says, "A peck of March dust is worth a king's ransom." We have confirmed, by many years' experience, the truth of the proverb which commends a dry spring, as leading to the most productive summer.

Marygold.—When this plant has its flower well expanded in the morning, the day will be fine. The small field marygold, *Calendra arvensis*, affords a more certain sign of rain when its flowers are closed in the morning.

Mares' Tails, or cormoid curl-clouds in the sky, forbode wind, and sometimes rain.

Martins fly low before and during rainy weather.—See *Swallows*.

Mice, when they squeak much, and gambol in the house, are said to foretel a change of weather, and often rain.

Missel Thrush.—Before storms the Missel Thrush is observed to sing particularly loud, and to continue to do so till the commencement of the rain: from which circumstance it is, in some places, called the Storm Cock.

Moles often afford us a prognostic of rain, by working and throwing up the earth into molehills more than usual.

Muscæ Volitantes, or the deceptive appearance of flies flitting before the eyes, which many persons are perpetually troubled with, occurs, in general, only before rain. Light specks seen on the sky, or on every object which we may happen to be looking at, are also signs that rain will soon fall. The same thing happens in winter before snow and sleet. This effect seems to be produced by some peculiar irritation in the retina, or other part closely connected with vision, and which has its remote cause in the peculiar electric state of the air before rain: it is most frequent before the cool rain which sets in after warm weather, and which is preceded by a cooler wind, possessing peculiar characteristics; this wind blows up the dust in clouds, sweeping, as it were, along the ground, and is usually recognised, to use the vulgar phrase, as "*blowing up rain.*" A headache sometimes follows all these *muscæ volitantes*, which shows, I think, that the atmospherical cause of them produces them by means of some general irritation of the constitution and stomach.

Moon.—The prognostics from the look of the moon are various, and were known of old. When she looks fiery, or red, like the colour of copper, wind is generally to be suspected; when pale, or confused with ill-defined edges, rain; when very clear and bright, fine weather.

The hornedness of the moon is also said to show a change of weather, when the horns are clearly defined. Instances occur rarely of a

double reflection of the moon, owing to the intervention of thin wane-clouds.

When the moon is near the full, or new, people are more irritable than at other times, and headachs and diseases of various kinds are worse. Insanity at these times has its worst paroxysms, and hence the origin of the term lunacy. The works of Drs. Meade, Sydenham, and Darwin, abound with illustrations of this periodical influence.

A vulgar prejudice has prevailed from time immemorial in Sussex, that a *Saturday's moon* brings blowing and wet weather. By some accident this has proved very true during the last twenty years. To ascribe such a phenomenon to the occurrence of the new moon on the day specially dedicated to Saturn, must, of course, obviously appear superstitious; but there may be natural causes why the conjunction of the sun and moon, happening at some such diurnal periods, may, in the long run, turn out to be connected with rough weather; and these periods once falling on a Saturday, would for a long time continue to do so, hence may have arisen this vulgar notion. Old shepherds, gardeners, hunters, and men of education, have alike testified to the fact. Indeed the whole doctrine of periodic phenomena is very little understood.

Nearness of objects.—The greater apparent nearness of distant objects, and the unusual clearness of the distances, are signs of rain. The same has been observed of the mountains and hills in the West Indies before the occurrence of the autumnal rains and tempests; some of the most violent hurricanes of our colonies have been preceded by an extraordinary appearance of nearness in the distant mountains. In this country, also, showery weather is never considered to be at the end, so long as the distant hills appear unusually near. This fact corresponded with the observation of Sir Isaac Newton, that the stars seem clearer and better adapted for observation in the clear intervals of showers, and before a change from fair weather to rain.

Nimbus, or Rain-cloud.—It may be noticed that clouds of any one of the several modifications, at the same degree of elevation, may increase so much as completely to obscure the sky: two or more different modifications may also do the same thing in different elevations, and the effect of this obscuration may be such as would induce an inattentive observer to expect the speedy fall of rain. It appears, however, from attentive observation, that no cloud pours rain until it has previously undergone a change sufficiently remarkable to constitute it a distinct modification, to which the term *nimbus* has been applied. This change seems to consist in the uniting of particles of water differently electrified, which, having a mutual attraction for each other, closely unite, forming visible drops of water, which, therefore, gravitate and descend in rain. The nature of this process will, perhaps, be better understood if we pay attention to what frequently happens in the rapid production of showers, and closely examine this process for ourselves. The ancient Romans

distinguished *Nimbus*, or the cloud itself, from *Imber*, or the falling shower of water.

Noises and Sounds, when they are heard from farther off than usual, often indicate a change of weather. That sound is heard at a greater distance in calm weather, in the stillness of the evening, and in the direction of the wind, is well known, and is easy of explanation. But, independently of these circumstances, there is something particular in the state of the air before rain, whereby it becomes fitter for the conveyance of sound, than ordinary. A lofty veil of cloud, which occurs before rain, has been supposed by some philosophers to act as a kind of sounding-board, so as to convey the vibrations of sonorous bodies farther than clear air; but this explanation is wholly insufficient. The sound of distant church bells, for example, is greater before rain than at any other time; clocks afar off then appear to strike louder, and, consequently, to be nearer than usual. Other noises too, as sawing, hammering, the whetting of the mower's scythe, or the whirling sound of mills, are all heard farther than usual; as are the crowing of cocks, human voices, and music of all kinds. It is a thing worthy of remark, that distant objects appear also nearer to the sense of sight, as well as to the sense of hearing, before and during showery weather.

Ocean.—There are various prognostics deducible from the appearance of the ocean, of which we shall enumerate a few. When the surface of the sea is rough without any wind blowing at the time, we may be sure of a gale before long; for the wind already blowing in some distant part of the ocean is the cause of the swell imparted to the sea. We have experienced this circumstance in the British Channel, and it has been followed before long by a gale.

Ocular Spectra are also frequently signs of weather. The large spots of light which seem as objects, but are in the eyes, denote the fall of rain, and a cooler air. For various other signs, see *Muscæ Volitantes*.

That the change of weather which produces ocular spectra, does so by means of disturbing the stomach and nervous system, seems probable from this circumstance, that similar spectra arise often from overloaded stomachs and indigestion, and from the excitement of the nervous system in fevers.

The ocular spectra of children, who go to bed with too full stomachs, or with irritable nervous systems, are to be referred to modifications of the real impressions of objects seen in the daytime, such as the passage of uncouth faces by the bed at night. The forms of specks and freckles, which pass in imagination before us with closed eyes at night, and which continually change their shapes, are referrible to the previous impression made on the retina and its auxiliary nervous parts, by accidentally beholding the figured paperings of rooms, or the patterns of printed calicoes, during the day.

Owl.—The various omens which vulgar credulity has attached to the hooting and screaming of this bird deserve particular attention. When an owl hoots or screeches sitting on the top of a house, or by the side of a window, it is said to foretell death. The fact seems

to be this: the owl, as Virgil justly observes, is more noisy at the change of weather; and as it often happens that patients with lingering diseases die at the change of weather, so the owl seems, by a mistaken association of ideas, to forbode the calamity.

Paraselene, or Mock Moons, forbode wind or rain.

Parhelia, or Mock Suns, forbode wind and rain. Peculiar refractions of the sun's light of any sort, indeed, are rather windy signs, particularly when the prevailing colour of the phenomenon is red.

Peacocks, when they squall more than ordinary, prognosticate rain. This prognostic is well known in the country, and does not often fail. When the sky has been perfectly clear at eventide, and when farmers have thought the weather about to be settled, I have often foretold a return of the rain from this sign. The squalling of the peacock by night often foretells a rainy day.

Petrels.—The stormy petrel, *procellaria pelagica*, is found to be a sure token of stormy weather; when these birds gather in numbers under the wake of a ship, the sailors are sure of an impending tempest.

Pigeons.—It is a sign of rain when pigeons return slowly to the dove-houses before the usual time of day.

Pintado.—Before rain, the pintadoes, or guinea-fowls, called comebacks, squall more than usual.

Pimpernel.—When this plant is seen in the morning with its little red flowers widely extended, we may generally expect a fine day; on the contrary, when the petals are closed, rain will soon follow. This is the same plant, apparently, which Lord Bacon calls *wincopipe*, and which has also been styled the *poor man's weather-glass.*

Pipes for smoking tobacco become indicative of the state of the air. When the scent is longer retained than usual, and seems denser and more powerful, it often forbodes rain and wind.

Pluviometer, or Rain-gauge, is an instrument to measure the quantity of rain, of which there are many and various sorts.

Plants usually expand their flowers well and perfectly on fine days, but many sorts close their petals against the coming of rain; hence we may often judge of the weather early in the morning by noticing the flowers. Plants are very apt to flag and droop before rain, particularly in summer, when, after long dry weather, the wind that is to bring up the rain begins to blow. Many good nautical observations may be made on marine plants.

Porpoises, when they sport about ships, and chase one another as if in play, and indeed their being numerous on the surface of the sea at any time, is rather a stormy sign. The same may be said of dolphins and grampuses. That the cause of these motions is some electrical change in the air, seems probable.

Quails are noisy before rain.

Quarries of stone and slate foreshow rain by a moist exudation from the stones. This seems analogous to the dampness on stones, stone-steps, and ornaments both of stone and of metal, before rain and in damp weather.

Rainbows are said to be signs that rain will not long continue, a

thing easily understood, because they can only be seen in a passing shower. A rainbow is, for the same reason, a sign sometimes of wet, because the first that is seen shows that showers, and showery weather, are at hand. Double rainbows are very rainy signs. But, after a rainy day, it shows that set rain is giving place to mere showers.

Raven.—When the raven is observed early in the morning at a great height in the air, soaring round and round, and uttering a hoarse croaking sound, we may be sure the day will be fine, and may conclude the weather is about to clear and become fair. On the contrary, this bird affords us a sign of coming rain by another sort of cry, the difference between these two voices being more easily learnt from nature than described.

Rays of the sun appearing in a cloud forbode rain. This phenomenon is, in fact, caused by the image of the sun being reflected in an intervening cloud, the reflected image radiating in the cloud.

Redbreasts, commonly called Robin Redbreasts, when they come near to the houses, and with more than usual familiarity lodge on our window-frames, and peck against the glass with their bills, indicate severe weather, of which they have a presentiment, which brings them nearer to the habitations of man.

Refractions of Light of any remarkable kind frequently forbode rain, and sometimes storms: at sea the knowledge of this is very useful. Circles round the sun and moon, mock-suns, and other phenomena of this kind, together with the unusual elevation of distant coasts, masts of ships, &c., particularly when the refracted images are inverted, are known to be frequent foreboders of stormy weather. What was the natural cause of that singular phenomenon which gave rise to the story of the flying Dutchman, so well known to mariners?

Rooks gathering together, and returning home from their pastures early, and at unwonted hours, forebodes rain.

Sheep, and other flocks and herds, turn their tails to leeward before and during rough weather, and seem to have a presentiment of its approach. They also foretell rain by their gambols and unusual agitation.

Smells, being condensed, and being longer retained by the air, and perceived farther off than usual, denote the coming of rain. The far propagation of sounds, and also the apparent nearness of distant objects, have the same prognosticative value, and indicate rain. Thus the greater perfections in the functions of these several senses, are alike forerunners of foul weather; a circumstance well worthy of the notice both of physiologists and meteorologists.

Snow.—The indications of this phenomenon are pretty much the same as those of rain, and we must judge of its coming by the state of the thermometer, the time of the year, and the wind then blowing. Many persons are unwell before large falls of snow.

Spiders, when they are seen crawling on the walls more than usual, indicate that rain will probably ensue. This prognostic seldom fails. In summer an unusual quantity of webs of the garden spiders denotes fair weather.

Stars.—Though the obscure and dilated appearance of the stars

denotes rain, because it shows that the atmosphere is thickening, as observed by Virgil; nevertheless, previous to a change to rain, and while the barometer is already sinking, some of the most clear skies are seen: by night, on such occasions, the starry firmament is unusually clear and sparkling, and the milky way seems prodigiously light: this, as Sir Isaac Newton observed, is just before the change: rain clouds soon form, and rain rapidly follows this transparency of the heavens.

Soot, when it takes fire more readily than usual on the back of the chimney, or on the outsides of pots or kettles on the fire, indicates rain. Rain is also said to be foreboded by the falling of soot in small flakes, which had been previously carried into the air from the chimnies. Soot also falls down the chimnies into the grate more readily against rain.

Starlight.—The dimness of starlight forebodes rain, as its greater brilliancy does also at times. The various colours of different stars when near to the horizon, and the alternation of colour observed in some of them, are curious subjects of future speculation.

Smoke frequently indicates the state of the air. When the smoke from chimnies mounts up very straight into the air, it is a sign of fine weather; on the contrary, when it blows down, rain will soon follow. Some chimnies smoke before a change of weather, because the wind often changes first, and gets, perhaps, into an unfavourable quarter.

St. Swithin.—When it begins to rain on St. Swithin's Day, which is the 15th of July, it is said to indicate forty days of wet weather. Now, though the limitation of this sign to a particular day is perhaps carrying the idea of St. Swithin's power a little too far, yet for many years we have noticed, that if a showery time set in about this day, we have usually several weeks of showery and variable weather in the sequel.

Stratus, or Fall-cloud, is a fog or mist, so called from being strewed along the ground, and from its consisting of a particular kind of clouds, which fall at night time to the ground. A stratus in the morning in autumn, often ushers in some of the finest days we enjoy.

Stomach.—This organ, in persons of weak and irritable constitution, is often deranged at the change of the weather, and its digestive powers are more under atmospherical influence than people are commonly aware of. Before storms it is particularly liable to uneasy sensations.

Swallow.—When the swallow flies low, and skims over the surface of the ground or the water, frequently dipping the tips of its wings, or bill, into the latter as it passes over its surface, we may always expect rain. The probable cause of this bird flying low before rain is, that its insect prey, foreknowing the approaching change, get lower in the air, and sport under the shelter of out-houses, by the sides of ponds and lakes, and under the shade of trees. Martins and Sand Martins do the same.

Swans, when they fly against the wind, portend rain.

Thunder in the morning is often followed by wind in the evening;

thunder in the evening by much rain and showers. Thunder is often preceded by hot, and followed by cooler weather.

Tinnitus Aurium, or singing in the ears, often indicates a change of weather. There is also a sensation of this kind, accompanied by temporary deafness, which is caused by a great rise of the barometer. A similar sensation is felt on descending from air-balloons and from high mountains and hills.

Toads, when they come from their holes in an unusual number in the evening, although the ground be still dry, usually foreshow the coming of rain, which will generally fall more or less during the night.

Tobacco and Smoking.—When the smoke from a pipe does not speedily disperse, but scents, strongly, the surrounding air, we may be sure of a good day for hunting. For the same quality of the air which retains the scent of the tobacco, will also cause the scent of the animal to remain.

Toothach, like other pains, is often a forerunner of some change of weather, and particularly that species which depends on inflammation of a diseased socket or gum. In certain kinds of weather, and particularly before rain or showers, decayed teeth and diseased gums are very uneasy, and the pain often ceases when the rain begins to fall. The periods of that sort of toothach which depends on the exposure of the nerve in the cavity of the tooth, seem to exist independently of any particular weather, and occur most frequently during the night, when the patient first gets warm in bed. The progress of this sort of toothach is often as follows:—The pain after awhile becomes continuous instead of being periodical, and by degrees subsides; but the socket then, and ultimately the gum, become diseased, and are thence liable to be affected by the state of the weather above described.

Urchins of the Sea, a sort of fish, when they thrust themselves into the mud, and try to cover their bodies with sand, foreshow a storm.

Vanes, or Weathercocks, are usually very imperfect instruments for ascertaining the direction and force of gentle currents of air.

Violins do not sound so well just before and during damp rainy weather as at other times, which seems to be owing to an effect produced by the air-damp on their strings, as well as on the wood itself. The same applies to many other musical instruments.

Vultures, when they scent carrion at a great distance, indicate that state of the atmosphere which is favourable to the perception of smells, which often forebodes rain.

Water-spouts at sea indicate the concurrence of different currents of air, and generally portend unsettled weather. They are produced at sea by the same apparent causes which on land cause *whirlwinds*.

Water Wagons, according to popular phraseology, are a sort of roundish little compact clouds, which fly along in the lower current of wind, and which seem to replenish and feed the rain-clouds; their previous appearance forebodes rain. They are of the modification of clouds called *cumulus*.

Water Fowls, and particularly those tribes which inhabit the sea-shores, were known of old to afford more useful and numerous prognostics of weather than any other indications which sailors can avail themselves of.

Wasps.—Abundance of wasps are said to denote a good fruit year.

Willow Wrens, a small genus of warblers, called *Ficedulæ* in modern books, are more frequently seen in mild, still, rainy weather, flitting about the willows, pines, and other trees, in quest of insects. These birds become numerous towards the middle of the summer, like the swallows, and other small birds, from the accession of broods of young.

Wind-vanes are described under the words Weathercock and Vane. An anemometer, to measure the strength of the wind, is also a useful instrument; the particular nature, fluctuation, and extent or rage of gales and breezes of wind, ought to be minutely observed with reference to their indicative import.

Weathercocks do not always show the real direction of a very gentle wind. The strange figures of them, usually the productions of capricious fancy, are one cause of their imperfection as vanes to indicate the wind. Griffins, half-moons, foxes, or figures of St. Margaret and the dragon, are not good shapes for weathercocks; they ought to be plain fans, the large surface of one side being counterbalanced against the weight of the other.

Whirlwinds forbode rain very often, and generally some change of weather. See *Water-spouts*.

Wind, as well as rain, may generally be foretold by certain prognostics. The sudden depression of the mercury in the barometer almost certainly foretells wind, and, in summer, is frequently an indication of storms. So certain, indeed, is the fall of the quicksilver a sign of bad weather, that captains of ships would do well to prepare against a gale whenever they observe it. The prognostics of windy weather are the fiery look of the clouds at sunset, mare's tail-clouds, the coloured cirrostratus, the snapping of the flame of candles, and numerous signs from animals, described in their proper place.

Woodcocks appear in autumn earlier, and in greater numbers, previous to severe winters, as do snipes and other winter-birds.

Wood-lice, as well as spiders, creep about on walls, particularly the damp walls of old houses and cellars, before rain.

Worms come forth more abundantly against rain, as do snails, slugs, and almost all our limacious reptiles.

Xeranthemum.—The flowers of this plant afford an example in exception to the general rule, being open all the time of rain as well as fair weather; before rain, however, the plant will sometimes droop.

Yarn, particularly hemp yarn, is a good hygrometer, and foreshows rain by getting shorter, and dry weather by lengthening again; because it is affected by that dampness in the air which so often forebodes rain, and which occasions, in our bodies, a sense of coldness and chilliness which the actual state of the thermometer would not

induce us to expect, and which in reality depends on our perspiration being carried off by the dampness of the surrounding air.

Zodiacal Light is a pyramidal cloud of light apparently emanating vertically from the setting or rising sun at the time of the equinoxes, which has been described by Mairan in his treatise on the Aurora Borealis. It seems to be some peculiar effect of refraction.

Observations on the Large Brown Hornet of New South Wales, with reference to Instinct. By the Rev. JOHN M'GARVIE, A.M. *In a Letter to* JAMES DUNLOP, ESQ. *Paramatta.**

DURING occasional hours of relaxation from more important engagements, I have amused myself of late in studying the habits and history of the large brown and black hornets of this country, which I know you have also done with much success. But as my views on the subject do not entirely coincide with yours, I cannot permit this, perhaps the last opportunity for many months, to escape, without making a few remarks upon it, especially as the excellent microscope I received from you (a present of inestimable value in this country,) will enable me to prosecute the subject with more precision than I have yet been able to accomplish.

There are few subjects that have occasioned more discussion to the naturalist and the moralist, than instinct. The one, desirous of resting his knowledge on a few mechanical principles, is unwilling to admit instinct as a direct, operating agent in animals, and particularly in insects, if any cause can be discovered that will account, even imperfectly, for their operations. The moralist, on the other hand, assigns to instinct every thing that indicates an ultimate design, though it cannot be a question with any man, that the same veneration for the Author of Nature would be excited, were every act of instinct reduced to the commonest laws of matter and motion. For He who implanted instinct, on the common view of the matter, must have implanted also the power of acting in conformity to known laws; and these actions, of course, become infallible proofs, that the laws which these individuals follow in their operation, existed before the individuals themselves; giving thus a proof, if any were wanting, that both were created by the same beneficent hand. Instinct, therefore, we conceive, should always be considered as assisted or modelled by organic structure.

Of all the works of instinct, none have excited more surprise than those exhibited by bees, hornets, and other creatures of the same kind, which form their hexagonal cells with such regularity and skill, that the most expert artizan might in vain attempt to imitate or surpass them. Why is it they have chosen this best of all forms "*stipare roscida mella,*" by which every atom of their labour becomes of use? Why do they never deviate from this rule? Why have they

* Read before the Wernerian Natural History Society, 12th January, 1828.

never advanced in improvement since the first of the race completed his primitive cell? This, of itself, in place of leading us to assign the effect to instinct, should lead us to ascribe it to the structure of the race, impelled by some principle beyond the reach of investigation.

Instinct implies a power of action for producing some effect, by mechanical means, without the agency of intelligence. To this view of instinct we are not disposed to object, if men do not stop at proximate causes; for, whilst bodily conformation and structure may serve to attain certain ends, the principle from which these flow may still be denominated Instinct.

The hornets of which we speak, are of several kinds. There is a small black species which forms a quadrangular cell, about a quarter of an inch in the side, and from which a number of young ones, to the amount of ten or twelve, may sometimes be taken, of a dry, hard, brittle structure and glossy aspect, without wings, and the head very indistinctly formed. This nest is often attached to the leaf of a wattle or gum-tree, in which case it is often hid by the leaves. It is firmly attached to the leaf by a thin gluten.

There is another very beautiful small nest, whose inmates we have not ascertained, but the form of which is more regular and surprising than that of the bee itself. It is six-sided, and the edges of the angles are formed into a rounded ridge.

The nest of the large black and brown hornet is extremely curious. It is fastened to the branch of a tree, sometimes a peach-tree, and sometimes to the twigs of a low shrub, close to the ground, and hid by high grass, being attached by a small button-shaped protuberance of dry, tough, gummy matter, which is impervious to rain or moisture, and which is, when taken off, in scales similar to the scales of a fish, but of a very different structure. They work downwards for about an inch, and then commence their cells, attaching the button of each cell to the stalk attached to the tree. They have sagacity enough to know that, as the weight below increases, the stalk and button must also be increased above, which they may be seen augmenting with great perseverance. They then increase the number of the cells, making them nearly equal in length, which is generally one inch and a half or two inches. The surface next the tree, that is, the bottom of the cells (for the open end is always downmost, and they build downwards,) is covered carefully over with a gummy substance of a silky aspect, but dry and brittle. The bottoms of the cells externally are distinct and circular. The button and stalk are of a pyramidal figure, very broad near the base, and contracting as they approach the upper end next the tree.

At the bottom of each cell, and covered with a thin substance, like tissue-paper, is a dark brown substance, composed of particles of wood comminuted, and similar to saw-dust. It certainly is not the young animal, but it may be stored up as food for it in its earliest stages of existence. Each cell is cemented to those next it by a hard glutinous matter, which may be obtained in considerable quantities near the bottom of the cells, as they are all tapering below,

and wide above, and the interstices are filled with this substance, by which they are joined to one another, and to the covering that spreads out from the stalk, by which it is fastened to the tree. The nests themselves are rounded below, and circular horizontally. The cells are not always hexagonal; they are, however, placed in very distinct rows, but they are neither so elegantly formed as the cells of bees, nor do they contain any liquid, nor is any use made of their contents. The cells are about two-fifths of an inch diameter, of different lengths, and the breadth of the whole nest is seldom more than that of the crown of a hat.

The insects connected with one nest are not numerous, sometimes amounting to twelve or twenty, sometimes to a few more. When the cells are formed, they seem to take great pleasure in going over them in succession, pushing their heads into the cells, and adding small portions to them by means of their long tongues, palpi, and forceps. They hatch their young in these; and when the young animal is in the cell, they close the mouth of it with the fine tissue-paper like substance, of which the sides of the cells are composed.

The stings of these insects are extremely painful, causing a fulness and deadness of the place affected, that is almost intolerable. Their sight is sharp and quick. They fly directly to the face. One man was stung, not long ago, in the centre of the eye. They attack the cattle in the field, which are terrified at them, except the pig, which is blessed with a happy insensibility to all their attacks, as he merely shakes his sides and his tail, and continues to eat peaches as before.

This insect has a beautiful appearance in the living state, having a number of yellowish-brown segments, on a black ground, around his body; his legs and wings being of the same colour; a fine yellowish colour presents itself on each shoulder, at the root of the wings, and there is a yellow stripe on the forehead. The rest of the body is a beautiful velvet-black, and the tips of the wings are tinged with a light purple colour. It has six legs, the two first of which it uses with great dexterity as hands. They may be seen frequently rubbing them, and thrusting their foot into their mouth, to besmear it with an unctuous substance, which may enable it to seize a firmer hold of its object.

It is from the structure of the fore-legs, which are admirably adapted for the purpose, that, in my opinion, the hexagonal cells derive their character of regularity. When the sun is hot, you may see the insect traversing round his cell, seizing the edge of it in his mouth, and adding a small piece to the sides. When he has done this, he sets his body close to a side, and clasping the cell firmly in his fore-arms, he continues rubbing it upwards and downwards for a considerable time; and as one cell is always a little higher than the one next it, he proceeds thus from side to side, and gives a six-sided form simply by rubbing and working upon the soft materials with his arms. A very little attention will show, too, that he can give it no other form than this or the circle. For his arms are so constructed,

that if he acts uniformly upon any of these sides or angles, as we have repeatedly seen him do, he must form a hexagonal figure, if the materials are pliant.

The arms are first composed of a joint near the body, extending a little outward, and moveable in every direction. To this is attached the arm, which is smooth, and somewhat powerful. Next this is the fore-arm, and next it are the feet, which have three hooks, a small one on each side, and a larger in front. Between each of

these is a powerful joint, and they are confined to a large angle, as they cannot be extended into a straight line. When the animal, therefore, has made the sides of his cell in a circular shape by the gluten from his mouth, and a quantity of pipe-clay, which he frequently employs in the building of it, he applies his body to it, and, placing the fore-arms around it, at an angle most convenient for itself, he continues to rub up and down till the shape has been given to the cell. The first angle is formed by the body and the arm; the second by the arm and fore-arm, and the third on each side by the angles formed by the fore-arm, and the feet or claws.*

In proof of this, it may be remarked, that the bottom of the cells is round, and the hexagonal form does not commence till the cell has attained a sufficient height to admit of the application of the animal's body and legs to the outside of the cell, after which, to the top of the cell, the hexagonal form is remarkably distinct. Besides, to leave no doubt about the matter, we have measured the legs of a full grown hornet, and then applied them to the sides of the cells, and out of 160 cells in one nest, found only half a dozen near the outside, that did not correspond exactly with the length of the arm or fore-arm, and these were probably injured or dried up.

In this respect, therefore, I think, that instinct may be pushed one step farther back from the demesnes of philosophy, since this very complicated and regular exhibition of animal sagacity may be accounted for from the organic structure and formation of the animal. The wonder still remains, why it should have been constituted with such powers. But this wonder is in common with that of every thing around us; and is continually excited in examining the wonders of the lower creation, especially in entomology, which, in this country, above all others, would require the united energies of a score of naturalists for many years. Its treasures are inexhaustible, and are almost entirely unknown.

When upon this subject, allow me to allude to a circumstance connected with the beautiful *Atropus Belladonna.* This butterfly, in the state of a grub, as it is here called, forms a pyramidal and sometimes a circular nest of small twigs, which it may be seen oc-

* The figure is considerably larger than nature.

casionally dragging up a tree, by short and easy stages. This is the case with the same insect when very small; but, in both stages, it may be seen moving about its head before it commences its journey, and stopping at regular intervals as if to reconnoitre. One unacquainted with its natural history, might suppose it was apprehensive of danger. But the fact is, that when it moves its head from side to side, it is spinning for itself a thread, which it fixes to the tree, and, when it is strong enough, it stretches out its fore claws, seizes hold of the thread, and raises itself upward, on the principle of the common rope-ladder. When you examine its path attentively, you see these steps placed at the most regular distances, as regular as if made by the hand of art, and intertwined in such a way, that if one should break, the next will keep the animal up. This is certainly instinct in one sense, but is common mechanics in another. For the animal seizes hold of the thread by the second pair of feet, stretches his head upwards, and makes the distance between the two steps of the ladder precisely that of the distance between his mouth and his second pair of arms, which is exactly one-fifth of an inch in a common sized animal. We have watched him ascending a smooth surface by this means, when it would have been thought impossible to raise a large circular cylindrical nest with so much despatch on such a surface. Such paths you have probably yourself seen long ago.

Ascribing effects to instinct, therefore, is a great source of error in natural history, and should not be resorted to, except in those cases in which no rational account can be given of the effect we contemplate; for if men were to stop short at second causes, every effect in nature might be denominated instinctive. The best possible means have been always adopted to produce the best possible ends. It is the business of philosophy to discover the latter, and trace them by that means to the grand intelligent source from whence they originated. I am, &c. [*Edin. New Phil. Journ.*

Sketches of the Progress of Inventions, connected with Navigable Canals. Compiled from various sources.

[From the Boston Journal of Science.]

The triumphant progress of the Great Western Canal, begun a few years since, by the state of New York, has fixed the attention of the public to works of this kind, in a degree, perhaps, unprecedented in any other country. In every district of the United States, canals are projected, and such are the supplies of water, and so favourable are other circumstances, that very few of the projects appear either chimerical, or, at least so far as the public is concerned, useless.

This advantageous mode of intercourse and traffic, is, in some of its most important parts, of modern invention; although some of the canals of the ancients were designed for commercial intercourse,

and on all it might have been practised in a degree; yet, irrigating and draining the land were the ends proposed by most of the canals, known in the early ages. The limit which the state of knowledge fixed to all works of this kind will be fully perceived, when it is recollected that locks, and, consequently, different levels, were unknown until within a few centuries. The ancient canals, therefore, were no more than artificial rivers, which could be made only through countries nearly level, and which, in cases of deviation from that direction, not only presented the obstacle of rapids to the passage of boats, but required constant attention and labour, to preserve the embankments from destruction, and, perhaps, the neighbouring country from inundation. Such were the canals of India, Egypt, and ancient Italy, and such, at this day, are the canals of China. Notwithstanding, however, the imperfection of these works, from the want of knowledge, some of them were formed on that scale of grandeur which so strongly characterizes the productions of ancient art. There seems to be good authority for believing, that the Red Sea was once united to the Nile, by a canal. One entrance of this canal is said to be yet remaining. The canal of Alexandria, which united that city with the Nile, still exists, although in a ruinous state. Formerly, the productions of Egypt were carried through this channel to Alexandria, thus avoiding the dangerous navigation of the mouth of the Nile, from whence they were shipped to Europe. The whole number of canals in Egypt, is said to have amounted to eighty, some of which were forty leagues in length, and in some places nearly three hundred yards in width. The Greeks have left no great works of this kind; at least none for the purposes of navigation. A cut through the isthmus of Corinth, which would make a navigable passage from the Ionian Sea to the Archipelago, though often proposed, was never effected. The canals of ancient Italy were neither numerous nor extensive. They were designed for the double purpose of drains and navigation. Such were the canals of the Pontine marshes, and those in the neighbourhood of the Po. In England, however, a Roman work, now called the Caerdike, formerly united the Nyne, near Peterborough, to the Witham, below Lincoln. It was nearly forty miles in length, and from the ruins, which still remain, must have been very broad and deep. Another canal, supposed to have been a Roman work, is still navigable, and connects Lincoln with the Trent, above Gainsborough, by one level of eleven miles. These canals are both situated in the English Fens, and are, of course, natural levels.

It has been observed, that locks were unknown to the ancients; they are still unknown to the Chinese. Some of the canals of China, however, are constructed on different levels, and their method of passing boats from one level to another is worthy of attention. The levels are connected by inclined planes, constructed of hewn stone. These inclined planes, in some instances, connect levels differing fifteen feet in elevation. In passing from the upper to the lower canal, the boat is raised out of the water and launched over the inclined plane, the last part of the operation, of course, requiring no great

labour, as the friction over the plane retards the descent of the boat. But in passing from the inferior to the superior canal, powerful engines are required. These consist of capstans, from which ropes are passed round the stern of the boat. The effort of a hundred men is sometimes required to effect the elevation of a loaded boat. The objection to this mode, taken in this simple and rude form, lies not only in the great labour required by it, but in the injury which must necessarily be done to the boats. The practice could never be adopted with the slightly timbered barges used in our canals, which are calculated to be supported by the fluid in which they move, and which presses with a force perfectly equal on every part with which it is in contact. There are some situations, however, where, from a scarcity of water, the inclined plane is necessarily substituted for the lock. Some works of this kind, are used on the continent of Europe; and in England, in some cases, where the weight of the descending, greatly exceeds that of the ascending commodities, as in the traffic between mines and furnaces, inclined planes are used with advantage. In these situations the descending and loaded boat, is made to drag up an ascending one, which is empty, or but lightly loaded, thus exhausting in a useful purpose, a force which not being expended in friction, as rollers or wheels are used between the boat and the plane, could not be otherwise controlled without some labour and cost.

In enumerating the improvements in canal navigation, we shall commence with the lock. The period when locks were invented does not now seem to be precisely known. On this subject, the writers in the Edinburgh Encyclopædia say, "We have been at some pains to trace the original discoverers of this important engine; and though our researches have not yet been attended with all the success we could wish, yet we have been enabled to acquire some new lights respecting the early history of an invention, which three centuries, perhaps four centuries, have not yet brought to its ultimate perfection. Belidor, in his *Architecture Hydraulique*, supposes the invention to belong to the Dutch, from some expressions used by Stevinus, an eminent engineer of that country, in his treatise *Sur la nouvelle Maniere de Fortification par Ecluses*, published in 1634; but that superficial inquirer does not seem to have comprehended the particular invention which Stevinus describes, who expressly says, that locks of the modern construction, a figure and very correct explanation of one which he gives, had been known in Holland from early times. His object was to describe a new kind of sea lock then lately invented, for the purpose of securing the harbours, and which might at the same time admit the passage of masted vessels. The difficulty was, to form gates which could be opened when the water on their two sides was at different levels. The inventions of several engineers there mentioned are described, and the preference given to the plan of turning gates, placed so as to fill up the frame of the common gates, and which, when let go, fall into the line of the stream.

"Stevinus first gives an account of the common mode of effecting

the first object, as it had been in use for a long time, viz. the raising a common sluice door by a windlass, which, he says, does not allow the passage of masted vessels.

"2. He describes the sluices used for draining low lands, consisting of two doors, butting against the tide and shutting of themselves, which, he says, are more useful than raising the sluices, because they admit of being larger, and require no attention to watch the tide; but, he says, they are also defective in not admitting masted vessels, when they are placed under the dyke, and in not retaining water to scour the channel.

"3. The third kind of sluices, serving to pass masted vessels, are made with two pair of pointed doors, like the second, but raised as high as the dykes themselves, comprising between them a receptacle for ships, with two small sluices made in the walls, or in the doors themselves. Then he describes briefly the mode of passing a ship through the locks.

"Besides these, he says others have been made which open of themselves, with the ebb falling on the bed, and rise with the flood; also gates which are drawn aside into the land, but their use is not convenient.

"Stevin also informs us, that he and several other engineers had agreed to study this subject, and communicate their inventions to each other. The following was the result:

"Adrian Janssen, carpenter of Rotterdam, invented the locket for holding a turning gate in its place. A turning gate had been made at Briel, which was retained in a groove at the bottom, out of which it was wound three inches by a rack, ere it could turn into the line of the stream.

"Stevin's mode was to have rising vanes the whole width of each butting lock-gate; Cornelius Dirricksen Muys of Delft, to have second lock-gates holding up the first; and Adrian Dirricksen of Delft improved Janssen's mode, by applying them in folding gates. He got a patent for it from the state, and built two at Maeslandsluis and two at Helvoetsluis of that kind, which yet exist. Stevin's whole account of this mode of securing harbours is well worthy of attention.

"Of the Italian authors, the first who enters into the history of the discovery, is Zendrini, in his treatise *Della Acque Corrente*, published in Venice, 1746, who says, that being interested in ascertaining the original inventors of locks, he had taken some pains to search the Venetian annals on the subject, and found that the first lock was invented at Stra, near Viterbo, by two brothers of the name Dominico, clock-makers, in Viterbo, who had a patent for its construction from the senate of Venice, in the year 1481. The patent describes, that these engineers had engaged to construct a sluice, (concha,) in which boats might pass without danger, and which being so contrived, that the water passing out with facility, the vessels would neither be required to be discharged nor drawn over. This account has been acquiesced in by Lalande and other writers; but Lecchi, in his book *Dei Cannali Navigabili*, alleges that, previous to this

period, in 1420, the lock had already been introduced in the navigation of Milan, by Fillippo Maria Visconti, as mentioned in his life, by Decembrio, one of his courtiers. And in 1188, Petentino, the architect of Mantua, had thought of it on his dykes on the Mincio, at Governolo, the first attempt at overcoming the fall of rivers in all Italy; so that Lecchi claims it for Lombardy. Nevertheless, there is every reason to believe that these cases were nothing more than the wear and single flood-gates already used for the navigation of rivers; for Bertazzolo, in his discourse upon the sluice of Governolo, published at Mantua in 1609, proposes a lock with a chamber, (sostegno,) to be built at the sluice of Governolo, as a new thing. This lock has since been established on the left bank of the Mincio; and, connected with an opening wear, it serves to hinder the turbid waters of the Po from filling up the lower lake of Mantua, while at the same time it preserves the navigation. Indeed, in many parts of Lombardy, wears with flood-gates are yet employed for river navigation, although locks exist of an early date, and some of them also of singular magnitude and boldness. To conclude, we may observe, that at all events, a very few years after the supposed invention in the Venetian state, the celebrated painter, architect, and engineer, Leonardo da Vinci, in 1497, applied locks to connect the Milanese canals derived from the Adda and the Tesino.

"We must next consider the claims of Holland, that other great cradle of the hydraulic art of Europe. We have formerly noticed, that the embankment of the different districts of Holland had chiefly taken place between the years 1000 and 1400. In 1253, a placart was granted by William, Earl of Holland, to the city of Haerlem, for the construction of the sluices of Sparendam. Those sluices must have necessarily been a lock; for it is expressly said to be constructed for the more convenient passage of ships, and a toll is appointed to be collected on the vessels which make use of it.

"About the same time, viz. 1255, the jurisdiction of Deftland, was established, and the ancient canal from thence to Leyden, completed. On this canal, at the separation between Deftland and Rhineland, is the basin of Leidsendam, which, as we have already observed, becomes, to all intents and purposes, a complete lock, by means of the stop-gates belonging to the two jurisdictions at either end, and it has always been used as such.

"At the same period, the citizens of Utrecht had formed an aqueduct from the river Lech at Vreeswyck; and in 1371, as we are informed by Hada, in the History of Utrecht, they deepened and enlarged this aqueduct, so as to make it navigable, and placed at the bank of the river Lech double flood-gates, or stop-gates of timber, by which the waters might be more easily kept out or introduced. (Hedæ *Hist. Epist. Ultraj.* Arnold. ii. *Episc.*) The structure was certainly a lock, as we see by a note upon the passage, describing an improvement which was made within the same century by the addition of a third gate, thereby converting it into a double lock. From this note, it is evident that the original structure permitted the passage of vessels, which William only rendered more secure during

the high floods of the lock, by the construction of the third gate on the side next that river, thereby forming two chambers instead of one; and by the care that is taken to mention the name of this artist, it appears that the original or single lock was not considered as any new invention. There is, therefore, strong reason to believe that in Holland the lock was known, and in use, at least a century before its application in Italy."

The construction of locks is not yet, perhaps, brought to that degree of perfection of which it is susceptible. An easy passage for the boats, durability, and the least possible expense of water, seem to be the principal ends to be had in view in forming locks. Some of the locks on the most celebrated canals, built a century or two ago, are very deficient in some of these particulars. Such, for example, are those on the canal of Languedoc, that noble work which unites the Atlantic to the Mediterranean. These locks are oval, or in some instances, of a circular shape, in the plan; forms adopted from a false idea that the pressure of the earth behind the walls would thrust them inwards. The consequence of this form is, that a large quantity of water is lost on the passage of every boat. The effect of the earth to overthrow walls built straight on the horizontal line, has been proved by the permanence of subsequent works, built in this manner, of no great amount, when they are otherwise properly constructed. The walls should always be built of masonry, if, indeed, iron should not eventually be introduced. The profile or figure given to the lock, as represented by a cross section, is of great importance, as on this the stability of the walls, in a great measure, depends. The walls should retreat or batter, as they rise, the batter being more considerable at the bottom, and decreasing as the walls ascend; at their summit they become nearly vertical. An inverted arch, sprung from the bottom of each wall, gives them an admirable support, preventing them from sliding inwards, and against this it is necessary to have some guard.

[TO BE CONTINUED.]

Account of Excavations made at Pompeii, from December 1826 *to August* 1827. *By* T. C. Ramage, Esq.

It was in the autumn of 1825 that I first paid a visit to Pompeii, and the impression it then made on my mind was by no means equal to what I had expected. I returned, however, several times, and found that every examination only increased my desire to investigate it more minutely. You are aware that Pompeii is about fourteen miles from Naples, and five from the crater of Vesuvius. Through it ran the Via Consularis, a branch of the Via Appia, which, striking off from Capua, passed through Naples and Pompeii, to Solerno. On entering the suburbs you set your foot on this ancient road, which, like all the other Roman ways, is composed of large unhewn blocks of stone. In Pompeii the pavement has been composed of lava, and

shows that Vesuvius must have been a volcanic mountain in some early period of the world, though history has left us no account of it. Alighting at the barrier, where a guard is placed, you enter its suburbs, which have been called Augustus Felix, and appear to have been founded by the colonies of Sylla and Augustus, whose names have been discovered on many of the monuments. One single villa has been completely excavated, and many others no doubt surround it, which will hereafter be exposed to view. The first coup d'œil is remarkably striking, and well fitted to make an impression on the mind; you see at once the whole length of the street, which is lined on both sides by tombs, some entire, and some in ruins. They are chaste in decoration, classical in design, and prove that they must have been erected before the taste of the Romans had become corrupted by the love of magnificence and grandeur, which they carried even to the grave. There rest whole families in eternal repose, as if they were still enjoying themselves around their Penates, and solemnizing some of those annual ceremonies in which all took a part. The mother is there stretched at the side of the father, and the children, according to their several ages, in regular order beside the mother.

Some of the tombs are most magnificent, and have been erected by a grateful country to citizens whose merits had entitled them to such a distinction; they are adorned with the palm and the laurel, and present the elegant forms of the lectisternium and bisellium. These noble monuments may be considered as altars erected by the Genius of Arts to the honour of Mystery and Death.

It was here that the inhabitants enjoyed themselves at even, under the shade of the cypress, which waved its mournful head over the tombs of their ancestors; it was here that they caught those genial breezes, which were so grateful after the heats of the day. What a strange contrast must their games, diversions, and tumultuous joy, have formed to the calm and silence which reigned in the graves where slept those who had once been as gay and as merry as themselves!

But as you have most probably seen a detailed account of the discoveries made previous to December 1826, I proceed now to give a short view of the progress that has been lately made in disinterring the ancient city of Pompeii from December 1826 to August 1827.

At present there is every appearance that we have at last advanced to a part of the town occupied by the more opulent class of citizens, and we are in hope of making some valuable acquisitions to our stock of antiquities. The streets have become more spacious, and the houses begin to have an air of splendour and neatness, far exceeding that of the houses situated along the sea coast. Indeed, as we know that the shops and taverns must have been in the vicinity of the Forum and public buildings, and as these are almost the only edifices that have been as yet uncovered, we may conclude that the private villas are still concealed from our view. The articles that have been found in these houses are generally superior, both in richness of ma-

terial and beauty of workmanship, to any that the Royal Museum has yet acquired, and display, in a very remarkable manner, the labour and ingenuity bestowed by the Romans, even on their commonest utensils.

The excavations have taken place principally in two directions,—in that street which is called the Street of the Arch, and towards the angle of the Forum, opposite the Basilica. In the winding lane which leads to the portico of the theatre, there have been several small houses excavated, exhibiting a considerable degree of ingenuity in the just arrangement, and agreeable union of all parts of the edifice, and a most extraordinary economy in the employment of ground. It may, indeed, be affirmed of them, what Pomponius Atticus said of some old houses he possessed in Rome, that there had been more ingenuity than money expended in their erection. One cannot help admiring the solidity with which many parts have been built, and the beauty of the *opus reticulatum*, which is equal even to the celebrated specimens of this sort of work, in the gardens of Sallust, at Rome. Here, also, were found several Ionic chapters, of a style purely Grecian, which you know is a very unusual occurrence in Pompeii. Their volute resembles the calyx of a flower, attached to its stem, which, turning downwards at the point, where the junction of the volute takes place, winds round the higher part of the shaft of the pillar,—an elegant device, quite new to us.

In the street of the Arch, the houses are larger and more splendid. One of them has its front decorated with representations of baskets, carved in a grayish coloured volcanic tufa, called by the Italians, Tufo of Nocera, from the quarries being discovered in the vicinity of that town. These baskets, exhibiting great accuracy of outline, are still, in some parts, covered with the stucco, which had been applied to them to furnish moulds for others intended to imitate the tufa. The cornice, formed of the same material, is lying on the ground, and furnishes a beautiful specimen of elegance in architectural disposition. On entering this house, we look across the atrium and the summer parlour. At the bottom of the peristylium, there is a fountain encrusted with shells and glass mosaic, similar to the one excavated some time ago. Near the outer door there is a small staircase, leading to the upper story, or rather to the roof, as its diminutive size prevents us from supposing the architect could intend it for any nobler purpose. The atrium is Tuscan, painted grotesquely with little flying figures on a red ground: among them the most remarkable are the figure of a winged female, with a garland of flowers in one hand, and a young boy in her arms; a little figure of a female in flowing drapery, with a palm branch in her hand; and a harp-player seated at her instrument. In the summer parlour, enriched by a beautiful mosaic pavement, the walls are ornamented with a variety of fruit and richly plumed birds. The portico, furnished with only two rows of pillars, has, on the opposite walls, a representation of the same number of columns, corresponding with the real ones, and between them there are landscapes sketched with great spirit, and of a much larger size than any hitherto discovered.

These are chiefly views taken on the sea-coast. On the left appears a large harbour, with several vessels at anchor: there is a building erected on a small island, united to the adjoining land by a singular bridge, which is approached by means of a stair, removable like a draw-bridge. In front is seen a two-oared bark, with sails exactly similar to those used at present in the Bay of Naples. At the side of this there is a building constructed on some rocks in the middle of the water, with a fisherman seated, and in the act of drawing his net. Among many other sketches there is one of a man on horseback, followed by a large dog, and wearing a hat which bears a considerable resemblance to those pointed ones which the peasants of Campania have at present. In the centre of the colonnade opposite the door, there is a fountain, in the form of a small altar, with its niche and top richly decorated with mosaic and shells. In the middle of the semicircular basin of this fountain, there was found, on a round pedestal, a little winged boy of bronze, with one hand raised, and embracing with the other a goose, which was in the act of flapping with its wings, and ejecting a stream of water into the basin. Towards the centre of the niche there is in the wall a scenic mask, from the mouth of which flowed another jet of water; and on the edge of the basin there was found another statue of bronze, three palms high, representing a fisherman seated with a small basket of fish in one hand, and extending the other, in the act of raising the net. From a rock completely encrusted with shells, on which the fisherman is seated, another jet of water has evidently been thrown. The features of this little figure are strongly marked, and full of expression. Besides a Caryatides of marble, there was found another figure of the same material, representing a young fisherman asleep, and covered with a sailor's mantle, such as is generally worn by the fishermen of the present day. The remains of the leaden pipes, with their stop-cocks, are plainly seen. In this house there was also discovered a beautiful marble table, of Greek workmanship.

Many rich candelabra, bracelets, rings, ear-rings, and medals have been the reward of these excavations. But the most curious discovery of all, is that of two glass vases, one of which contained olives, with the oil in which they had been placed eighteen centuries before; and the other nothing but pure oil. It may not be uninteresting to give the chemical analysis of these substances, by Professor Covelli of Naples.

Analysis by Professor Covelli.

The olives were found in a quadrangular glass vase, with a large mouth. The oily substance was inclosed in a cylindrical glass vase, with a narrow neck, and a small handle.

Examination of the Olives.—The upper half of the vase containing the olives, was full of volcanic ashes and pebbles; the olives, mixed with a kind of buttery substance, occupied the lower half. They have the form and size of that variety commonly called Spanish Olives; some of them have even still their *pedunculus* or flower-stalk. The kernels are less oblong than those of the Neapolitan

species, and also more swollen; the longitudinal streaks are more strongly marked. Their colour is black, but mixed with small particles of a greenish matter, which, with the aid of a powerful lens, it was discovered were those lichens produced on organic substances in a state of putrefaction; but these little plants were not observable at the moment of their discovery, and have no doubt arisen from the action of the air, which, in a few hours, had produced such an alteration in their superficies, as had not been accomplished by the influence of so many centuries. This is a proof that these olives, gathered eighteen centuries before by the subjects of Titus, are as fresh and sweet as those produced by Francis I. Indeed, these ancient olives are still soft and pulpy; they have a strong rancid smell, a greasy taste, and leave upon the tongue an astringent and sharp sensation. They are so light, that they swim upon water; the pericardium or seed-vessel shows still its organic texture, though the parenchyma is in that state of alteration which the maceration of a few months usually produces. The kernels are still hard; so much so that a knife can scarcely penetrate them. The oily part of the parenchyma, though in very small quantities, when analyzed carefully in the usual method, has been found to be changed entirely into oleic and margaric acids, which are the fundamental principles of the fixed oils, acidified by oxygen, and form the basis of our soaps. These changes happen generally in oils exposed for some time to the air. This proves that the action of eighteen centuries, which has left untouched the fundamental principles of the oil, has effected no greater change than what is produced by a few months.

The kind of oily substance in which the olives are enveloped, is of a brownish-yellow colour, soft like butter, has a strong rancid smell, soils paper like fixed oils and greasy substances, is melted by a moderate heat (60° or 70° cent.) warmed on a leaf of platina; it burns with a beautiful white flame, without leaving any thing but small, white, flaky ashes, so light that the smallest puff disperses them. With the alkalies it forms soap; distilled in close vessels, it gives out carburetted hydrogen gas, acetic acid, carbonic acid, carbonic acid gas, and a residue of carbon. This buttery substance, tried by Cheuvreul's method, is found to be composed of oleic acid in large quantities, a small portion of margaric acid, and a substance analogous to the sweet principle of fixed oils, but which differs in many respects, and which may be a new production; and, lastly, an earthy substance, in very small quantities, arising from the volcanic ashes which filled the upper half of the vase.

Examination of the Buttery Substance found in the narrow-necked Vase.—This substance is much softer than the preceding: it has a yellowish-green colour, has a strong rancid smell, and exhibits in the mass a number of brown globules, similar to the spawn of fish, but which cannot be made out even by a powerful lens. This substance resembles that found with the olives: it is composed of the same principles, though it may contain a larger quantity of oleic acid, and of that unknown substance analogous to the sweet principle of fixed

oils. It appears, indeed, to have been nothing else but the oil of olives, containing some vegetable salt.

[*Edin. New Philo. Journ.*

On Sea Serpents and Colossal Medusa. Extracted from a letter from* C. TELFAIR, ESQ. *July 20th,* 1827, *to* R. BARCLAY, ESQ. *of Bury Hill.

I HAVE read with great pleasure your very highly interesting communication about the sea serpent, as, also, the very profound and learned disquisition on that and similar subjects by your eminent friend, S. S. Duncan Esq. (of Oxford.) Every person who has been much in the Bombay trade must have seen countless shoals of sea serpents off that coast. I myself have seen them for hours accompanying the ship I was on board of, in 1809, when going to Bombay, and every person I have spoken to on the point here, has appeared surprised that any doubt could exist about it. Those which I saw, might be about 40 feet long, from estimation; they were beautifully coloured, and moved as rapidly as the ship, going seven or eight miles an hour: smaller ones still more common. On the coast of this island, an immense *medusa* was thrown on shore, in a violent gale of wind, in 1819; it was within seven miles of my Belomber estate. It must have weighed many tons. I went to see it when the gale had subsided, which was not for three days after its being cast upon the sand, but it had already become offensive, and I could not distinguish any shape. The sea had thrown it high above the reach of the tide, and I instructed the fishermen who lived in the immediate neighbourhood to watch its decay, that if any osseous or cartilaginous part remained, it might be preserved; it rotted, however, entirely, and left no remains. It could not be less than nine months before it entirely disappeared; and the travellers were obliged to change the direction of the road for nearly a quarter of a mile, to avoid the offensive and sickening stench which proceeded from it. [*Ib.*

Chinese Method of Fattening Fish.

THE Chinese are celebrated for their commercial acumen, indefatigable industry, and natural adroitness, in making the most of every gift of nature bestowed on their fertile country. Useful as well as ornamental vegetables engross their every care; and animals which are the most profitably reared, and which yield the greatest quantity of rich and savoury food, are preferred by them for supplying their larders and stews. Their *hortus dietetica* would form a considerable list; and though they do not use such a variety of butcher's meat and fowl as Europeans do, yet, in the articles of pork, geese, and ducks, they surpass, in the use of fish they equal us; and

in their domestication and management of them, they excel all other nations. A few observations on their *piscinas*, or fish-stews, is the design of this paper; not merely as an historical description, but as an object for imitation in this or any other country. For twenty or thirty miles round Canton, and as far as the eye can reach on each side of the river, on which that city stands, the general face of the country appears nearly a level plain, with but little undulation of surface. The level is, however, richly studded with beautiful hills, which diversify the landscape, and seem to rise out of the plain so abruptly, that they form the most picturesque features, united with the most pleasing combinations. The soil of the plain consists of a pure alluvial earth, of great fertility and depth, and very retentive of water; which, by the way, is a proof that, notwithstanding their claim to high chronological antiquity, the waters of the deluge remained much longer (perhaps for ages) on this portion of the continent of Asia, than it did in the interior: and the circumstance of many of their hills being cultivated to the very top, their numerous water plants, and their almost amphibious habits as to their domiciles, are still further proofs that the country was once more of an aquarium than it now is. Hence the facility of making canals, which are their high-roads (as wheel-carriages and beasts of draught are too expensive appendages for the systematic economy of the celestial empire!) and hence the ease with which a pond may be made in any otherwise useless corner. Such tanks, or ponds, are generally met with in market-garden grounds, where they serve the double purpose of a reservoir, and a stew for rearing and fattening fish.—When a pond is made for this purpose, and filled with water, the owner goes to market, and buys as many young store-fish as his pond can conveniently hold; this he can easily do, as almost all their fish are brought to market alive. Placed in the stew, they are regularly fed morning and evening, or as often as the feeder finds it necessary; their food is chiefly boiled rice, to which is added the blood of any animals they may kill, wash from their stewing-pots and dishes, &c. —indeed, any animal offal or vegetable matter which the fish will eat. It is said, they also use some oleaceous medicament in the food, to make the fish more voracious, in order to accelerate their fattening; but of this the writer could obtain no authentic account.—Fish so fed and treated, advance in size rapidly, though not to any great weight; as the kind (a species of perch) which came under observation, never arrive at much more than a pound avoirdupois; but from the length of three or four inches, when first put in, they grow from eight to nine in a few months, and are then marketable. Drafts from the pond are then occasionally made; the largest are first taken off, and conveyed in large shallow tubs of water to market; if sold, well; if not, they are brought back, and replaced in the stew, until they can be disposed of. This business of fish feeding is so managed, that the stock are all fattened off about the time the water is most wanted for the garden crops. The pond is then cleaned out, the mud carefully saved, or spread as manure,—again filled with water, stocked with young fry, and fed as before.—An intelligent Chinaman,

from whom the writer had the above detail, and who showed him as much of the process as could be seen during a residence of three months, declared, as his belief, that a spot of ground, containing from twenty to thirty square yards, would yield a greater annual profit as a stew, than it would in any other way to which it could possibly be applied.—That fish may be tamed, suffer themselves to be caressed, and even raised out of their natural element by the hand, has been long known to naturalists; witness the famous old carp formerly in the pond of some religious house at Chantilly, in France, with many other instances on record. But it is probable no people has carried the art of stew-feeding fish, and practised it as a profitable concern, to such lengths, as is done by the Chinese at this day. [*Quarterly Journal of Science.*

On a Method of Cleaning Silk, Woollen, and Cotton Goods. By Mrs. Anne Morris.

[From the Transactions of the Society for the Encouragement of Arts, &c.]

Take raw potatoes, in the state they are taken out of the earth; wash them well; then rub them on a grater, over a vessel of clean water, to a fine pulp; pass the liquid through a coarse sieve, into another tub of clear water: let the mixture stand, till the fine white particles of the potatoes (the *fæcula*) are precipitated: then pour the *mucilaginous potato-liquor* from the fæcula, and preserve this liquor for use.

The article to be cleaned should be laid upon a linen cloth, on a table; and, having provided a clean sponge, dip it into the potato-liquor, and apply the sponge thus wet upon the article to be cleaned, and rub it well upon it, repeatedly, with fresh portions of the potato-liquor, till the dirt is perfectly loosened: then wash the article in clean water several times, to remove the loose dirt: it may afterwards be smoothed and dried.

Two middle-sized potatoes will be sufficient for a pint of water.

The white fæcula, which separates in making the mucilaginous liquor, will answer the purpose of *tapioca;* will make a useful nourishing food, with soup or milk; or serve to make starch and hair-powder.

The coarse pulp, which does not pass the sieve, is of great use in cleaning worsted or woollen curtains, tapestry, carpets, or other coarse goods.

The mucilaginous liquor of the potatoes will clean all sorts of silk, cotton, or woollen goods, without hurting the texture of the articles, or spoiling their colours.

It is also useful in cleaning oil-paintings, or furniture that is soiled.

Dirty painted wainscots may be cleaned, by wetting a sponge in the liquor, then dipping it into a little fine clean sand, and afterwards rubbing the wainscot therewith.

On a difference in the velocity of Intense and Feeble Sounds.

In some interesting remarks upon sound in the Edinburgh New Philosophical Journal, Mr. Meikle has called in question the truth of the received doctrine, that all sounds, whether loud, or faint, move with the same velocity. Although this is true, in ordinary circumstances, when the sounds have not much intensity, (as when we listen to distant music,) yet it may cease to be true with regard to the intense report of a cannon. Indeed, as Mr. M. well observes, theory would lead us to suppose that the enormous quantity of heat which accompanies the explosion, would increase the elasticity of the air, and the velocity of the sound, much more than in the case of sounds created by simple percussion.

It is true, that in this part of the world, no such difference has been observed, which may arise either from the comparison never having been carefully made, or from the difference of velocity being really inappreciable. In the frozen climates of the north, however, such a difference, if it exists, may be expected to manifest itself, for in an atmosphere, perhaps a hundred degrees of Fahrenheit colder than that in which European experiments have been made, the heat at the mouth of the cannon, is (relatively to the temperature of the air) very greatly increased. Such, I think, is the conclusion of theory, and such is, also, the fact, as appears from the following decisive observation, for which science is indebted to the Rev. George Fisher, the astronomer in captain Parry's northern expeditions. I shall give it in his own words.

"The experiments on the 9th of February, 1822, were attended with a singular circumstance, which was, the officer's word of command 'fire,' was *several times*, distinctly heard both by captain Parry and myself, about one beat of the chronometer, (nearly half a second) after the report of the gun; from which it would appear, that the velocity of sound depended, in some measure, upon its intensity. The word 'fire' was never heard during any of the other experiments. Upon this occasion, the night was calm and clear; the thermometer 25° below zero, the barometer 28.84 inches, *which was lower than it had ever been observed before at Winter Island.*"

The last circumstance was, probably, not accidental; and if it is possible, in our climate, to distinguish the velocity of the sound of a bell from that of a cannon, it is at a time of diminished elasticity of the atmosphere, indicated by a low state of the barometer, that the attempt is most likely to succeed.

[*Quarterly Journal of Science.*

Distances at which sounds are heard.

"I recollect being, many years ago, at the west end of Dumferline, and hearing part of a sermon then delivering at a tent at Cairninghill. I did not miss a word, although the distance must be something about two miles. It was the late Dr. Black, of Dumferline,

who preached, and who, perhaps, has seldom been surpassed for distinct speaking, and a clear voice. The sound was such as I should have expected, under favourable circumstances, at a quarter of a mile. The wind, which was steady, but moderate, came in the direction of the sound. I was riding westward, and at length saw the doctor finishing his sermon, otherwise I should have doubted whether he had been at such a distance. Whether the sound had run along the road, as in a tube, I cannot say. I recollect little of what sort of road it is; part, I think, has pretty good dykes, which, aided by the wind, might guide and confine the sound." [*Jamison's Journ.*

On the effect of Wind upon Sound.

Amongst other observations upon this point, Mr. Meikle says, "It is generally supposed that the relative velocity of sound and wind is not affected by the motion of the latter; but this opinion stands much in need of confirmation. It is clear, that the effect of wind or sound is very different from merely bearing it along, as a current in the ocean does a floating body. For, in this way, the intensity would undergo no sensible change; whereas, we know that, in most cases, wind annihilates sound when opposed to it, and magnifies it prodigiously, when moving in the same direction. The most natural inference which we can draw from this, is, that wind reflects sound in the opposite direction; something in the way that the tide sends the *bore* up a river. The tremendous explosion of the Stobb's Powder Mills, in 1824, showed, in a very striking light, how feebly, and to how short a distance, sound moves against the wind, whilst it is prodigiously strengthened to leeward. A moderate breeze then blew from the south-west, and, although in the opposite direction, the report was loud, and the houses sensibly shaken to the distance of thirty miles, yet at three miles to windward, very few persons heard it, and those but feebly. [*Ibid.*

Fall of the Lake Souwando in Russia.

This lake, situated in the parish of Sakkola, in the Russian government of Wibourg, and surrounded by the lands of the Barons Friedrichs, was near forty versts in length, and had the form of a Γ, or Greek G. Before the year 1818, it was separated from the lake of Ladoga by an interval about a verst in width, called Taipale, on which was a sandy hill; its waters flowed into the river Wuoxa, which united the lakes of Saima and Ladoga. On the 14th May, 1818, the waters of the lake Souwando, increased by the thaw and the tempests, overcame the natural dyke at the foot of the lake, threw down the hill of sand, rapidly flowed into the lower lake, carrying away all the surrounding grounds, and for ever destroyed the barrier which had previously separated them. A chapel and a countryman's house were carried away, with the pastures and meadows; the waters of the lower lake were much disturbed, and the surface covered with ruins. The level of the lake Souwando fell twelve archines and a half; its length is now only fifteen versts. Its waters no longer flow

off by the Wuoxa, but pass into the lower lake by several falls through a deep canal. The land which has been uncovered by the water is already cultivated, and the beauty of the surrounding country said to be increased.—[*Bull. Univ.*

An Examination of Mr. A. Spencer's *remarks on the Adhesion of Disks, published in the Franklin Journal for July.*

Fig. 1. Fig. 2.

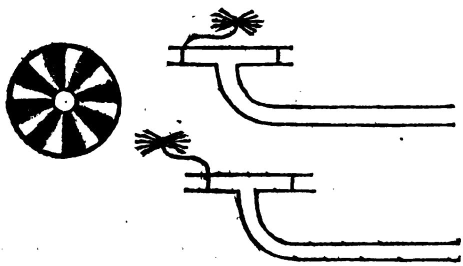


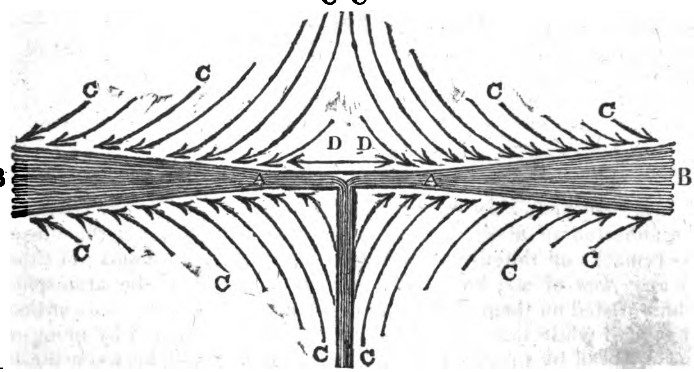
Fig. 3.

TO THE EDITOR OF THE FRANKLIN JOURNAL.

Sir,—In your July number, I have observed a theory respecting the adhesion of disks, by Mr. Asa Spencer. Towards the close of his remarks on the subject, he states that "the adhesion is not caused by any *flow* of air, but by the steady *pressure* of the atmosphere, which rested on them at the time the blast commenced, and continues unabated, while that on the inner surfaces is lessened by being met and opposed by the force of the blast, running out between the two inner surfaces of the cards." From a variety of experiments made, I am induced to adopt a theory directly the reverse of Mr. Spencer's: and think the adhesion is caused by a current of air falling nearly at right angles with the surfaces of the disks, at, and within their circumference; the velocity of which current is greatest at, and without the circumference. To test the truth of my theory, I have made use of the modified instrument here described. Take two circular pieces of sheet copper, about one inch in diameter, place them asunder about the eighth of an inch, with their surfaces parallel; retain them in this position, and in the centre of one of the plates, introduce a bent tube about the eighth of an inch in diameter; place through the upper plate a bent wire with a very fine point, that may be moved by the finger either over the centre of the plate, or at a point a short distance beyond the circumference: upon the point of this wire as in Fig. 2. immediately over the centre of the upper plate, put a small fan, such as communicates motion to a smoke jack, three-eighths of an inch in diameter; (see Fig. 1.) in this position of the fan, however great the blast, it will not revolve; next move the point outside of the circumference, and place the same fan upon it as in

Fig. 3, and by a comparatively slight blast through the bent tube, it will revolve rapidly. It does, therefore, appear, that at a short distance within the circumference of the disks, on their outward surfaces, there is little power exerted to induce adhesion—but upon a belt formed by the circumference, and an inner concentric circle, the power is exerted. The drawing, Fig. 4, with the following description, will fully explain the theory. The atmosphere surrounding the disks, is a fluid comparatively in a state of rest; motion communicated to a part of a fluid, produces a corresponding motion to all parts of the fluid in contact: which motion decreases in velocity as it recedes from the spot whence it received its impulse, owing to the resistance of the surrounding parts. The only effect produced by blowing through the tube, is, the mechanical destruction of the equilibrium of the surrounding air.

Fig. 4.



When the air is moved in the direction from A to B, its greatest velocity is immediately at A, as it leaves the disks; and continues to decrease, gradually, as it approaches B. This lateral motion destroys the equilibrium of the surrounding air, and causes a concurrent draft to fall upon the surfaces of the disks in the direction of the bent arrows from the ends marked C, to the barbs, which draft of air increases in velocity from C to the barbs, at which place it *nearly* equals the *velocity* of the *lateral current.* Now the pressure of air, between the disks, tending to separate them, is only as the *area of the tube.* The power inducing the adhesion, is the accumulated pressure, by a current of air moving with *nearly* the same velocity as that from A to B, exerted upon the *whole circumference* of the disks, in the direction of the bent arrows.

In consequence of the lateral direction of the current of air, as shown in the direction of the straight arrows marked D, or, rather, the obliquity of this current, the small fan would not revolve when placed on the centre of the plate: but, when brought under the accumulated draft at the circumference, moving nearly at right angles with its surface, it revolved rapidly. W. C.

ENGLISH PATENTS.

Patent granted to Henry Aspney Stothert, *of Bath, Founder, for improvements on, or additions to, Ploughs. Dated April* 4, 1827.

The plough represented in the drawing of the specification of this patent, has two wheels under the head of the beam; one of which, that is intended to go on the unploughed part of the field, is smaller than the other; and has besides the axle of this wheel, fastened to a dove-tailed block, that is made to move up and down in a similarly shaped vertical groove, as required, by a vertical screw that turns in the solid dove-tail, and has a winch at its top, which, besides its usual office, is made to serve as a stop to prevent the screw being moved from its proper position, by a pin that passes downwards through its handle, which comes in contact with the frame work to which the wheels are attached, when not drawn upwards, so as to permit the winch to move above it.

At the upper part of the same frame work, but nearest to the side next the large wheel, a nut turning on another vertical screw sustains a metal ball, that is embraced by a socket, which is attached to the head of the beam by a collar joint, that admits the beam to be moved round its own axis, while the ball and socket joint allows of a circuitous motion horizontally; and as the regulating nut of this latter screw is raised or lowered, the ball that is attached to it elevates or depresses the head of the beam, and thereby determines the depth to which the share enters the earth. The wheels, and the frame work mentioned, and, indeed, all the other parts of the plough, except the beam and handle, are made of iron; we only mention one handle, because but one is represented in the drawing, though some parts of the text make the intention of this doubtful.

The part to which the horses are attached, and which is somewhat similar to the same part in common ploughs, is fastened to a short horizontal bar, through which two vertical bars pass, to which it is fixed by moveable pins, for which holes are provided in the bars; by means of which the point of draft can be raised and lowered, as may best suit the height of the horses; and from the parts just described a connecting rod proceeds to the body of the plough, which has a short piece fastened to it that joins it to the beam also, at about one-third of the length of this latter from the coulter.

The turn-furrow of this plough is an iron plate curved into a form somewhat similar to the mould boards of the most approved ploughs, but which differs from them in having its curves so constructed, that a ruler or right line applied to any part of it, either vertically or horizontally, when it is in its proper position, will touch its surface in all parts. This plate has one set of perforations made through it that are long and narrow, to admit the air to pass, which the patentee states will have the effect of preventing the earth from sticking to it; and another set that may be either square or round, by which the iron stem of a short curved blade or knife, may be fastened to it in different places by a nut, so as to project from it horizontally at

right angles, to cut the furrow into slices; two or more of these knives may be used at the same time, to increase the number of the slices as required.

All the apparatus described may also be used with ploughs that have only a single wheel. [*Ib.*

Patent granted to DAVID BENTLEY, *of Eccles, Lancashire, Bleacher, for an Improved Carriage Wheel.* Dated May 8, 1827.

THIS carriage wheel is framed in a peculiar manner, with a view to make it altogether stronger, and to remedy the defects of the common nave, that is much weakened by the mortices made in it for the spokes, which come so close together, as to leave a much smaller portion of wood, to connect the parts at each side of them, than is generally supposed.

The metal box of the wheel in Mr. Bentley's mode of construction is larger than that commonly used, and has as many semi-cylindrical grooves, or shallow channels, made parallel to the axle at the surfaces of its two extremities, as there are spokes in the wheel, one half of the number being made at one end, and the other half at the other end, and so arranged, that the divisions between the semi-cylindrical grooves at one end of the box, shall be opposite to the central bottom lines of the similar grooves at its other extremity; the box has besides, four pieces about an inch high and broad, and about half the length of the box, projecting from its middle at right angles to each other, whose use is to keep the nave from turning on the box.

The wooden nave being firmly driven on the box so prepared, has excavations made at right angles to the axles at each of its extremities, opposite to the semi-cylindrical grooves; each of which excavations is fitted for the reception of the butt of a spoke, in such a manner, that the inner ends of the spokes may come closely in contact with the grooves of the metal box, while their outer extremities shall terminate in the plane of the rim of the wheel, close to the iron tire; and as this plane passes through the centre of the nave, every pair of the spokes, will, when viewed across the wheel, appear to form two sides of a triangle, of which the nave is the base, and will, in fact, give the wheel all the strength sideways, which triangular framing is ever found to produce wherever it is introduced. A circular metal plate is then placed, vertically, on the axle at each end of the nave, having cavities made at their centres to admit of this arrangement, and being perforated opposite to each division between the spokes in two places for the transmission of iron screw bolts; which passing across between them through the nave, are drawn tight by nuts, so as to press the plates against the ends of the nave, and firmly secure the inner extremities of the spokes, against the sides of which they are also pressed by the action of the nuts on the screw bolts.

The iron tire or rim of the wheel, is one continued hoop, and is made hollow at its inner side next the felloes, and rounded at its ex-

ternal surface, so as to present a nearly semi-circular section, if it were cut across in any part; the felloes are fitted so as to lie close to the internal cavity of this hoop, and when the several parts of the wheel are to be put together, after being fitted to each other, the outer extremities of the spokes are first put into the mortices made for them in the felloes, then these latter are arranged in their places, within the cavity of the hoop, after which, or at the same time, the inner ends of the spokes are placed in the cavities prepared for them, in the opposite side of the nave, and, lastly, the round end-plates are fastened to each side of the nave by the bolts; the nuts of which in being turned up tight, besides keeping the inner ends of the spokes in their places, as mentioned, will, according to the patentee, have the farther effect of pressing their outer extremities against the hoop, by causing the inner ends of those at the opposites sides of the nave to come closer together. All the nuts are placed at the carriage side of the nave, and, to prevent their getting loose by the motion of the wheel when in use, they are arranged so as to lie in two concentric circles a small distance asunder, and after they are screwed up tight, a ring that is made of the exact size of the space between the two circles of nuts, is fastened into it by wood screws, so that none of them can be turned again in any material degree until this ring be removed.

As the felloes are at first merely placed loose within the cavity of the hoop, as mentioned, some farther fastening and bracing will, of course, become necessary for them, and the method which the patentee takes for this purpose, is to place small wedges in two places at opposite sides of the rim, between their ends, pointing towards the rim, and a small screw bolt being put through each of these wedges in the same direction, and also passing through holes made for them in the hoop, are drawn tightly against this latter, by nuts at its outside, by which means the wedges are made to enter farther between the ends of the felloes, and thereby to press them against each other, so as to produce the intended effect above-mentioned.

The wheel is represented in the drawing that accompanies the specification, as having nine spokes, and nine pairs of bolts across the nave, in the intervals between their inner extremities. [*Ib.*

Specification of the Patent granted to Henry Constantine Jennings, *of Devonshire Street, Portland Place, in the county of Middlesex, Practical Chemist, for certain improvements in the Process of Refining Sugar.* Dated October 22, 1825.

To all to whom these presents shall come, &c. &c.—*Now know ye*, that in compliance with the said proviso, I, the said Henry Constantine Jennings, do hereby declare the nature of my said invention to consist in a rapid and effectual mode of depriving raw or muscovado sugar of its colouring matter, by means of rectified spirits; and in further compliance with the said proviso, I, the said Henry Constan-

tine Jennings, do hereby describe the manner in which I perform my said invention by the following description thereof, (that is to say;) I wash raw or muscovado sugar in rectified spirits of wine, rum, brandy, or any liquor being principally alcohol, which has very little affinity to saccharine matter, or sugar, and a great affinity for colouring matter, water, treacle, &c., of which the impurities of raw or muscovado sugar consist; I use any conical vessel holding from 500lbs. to 1000lbs., having a wire copper guage or perforated bottom; and I assist the process, by using all and every of the well-known means, whereby liquids are made speedily to percolate through solid substances, whose parts are not in actual contact; these means are hydrostatic, hydraulic or hydropneumatic. When any spirit is passed through the mass of sugar, so as to drop no more, I pass about 30 gallons of saturated sirop through the mass of sugar; this removes all, or nearly all the spirit of wine, and leaves the sugar only moistened by the sirop, and ready for putting into the hogshead. The spirit, or rum, that has combined with the colouring matter and water &c. may be used again over inferior sugars, and after it is very thick, it may be rectified, and the spirit re-obtained in an uncombined state, without much loss. Now whereas, I do not claim as any part of my invention, either the conical vessels before described, or any part of the apparatus to be used in the process of refining sugar as aforesaid: but I only claim as my invention the application of rectified spirits, being principally alcohol, for that purpose, such rectified spirits having properties peculiarly adapted to the said purpose, and performing the operation of refining more rapidly and effectually than any liquor now in use for that purpose. And whereas such my invention, being, to the best of my knowledge and belief, entirely new, and never before used within that part of his said majesty's United Kingdom of Great Britain and Ireland, called England, his said dominion of Wales, or town of Berwick-upon-Tweed, nor in any of his said majesty's colonies or plantations abroad, I do hereby declare this to be my specification of the same, and that I do verily believe this my said specification doth comply in all respects fully and without reserve or disguise with the proviso in the said hereinbefore part recited letters patent contained, wherefore, I hereby claim to maintain exclusive right and privilege to my said invention.

In witness whereof, &c.

Obs.—The process as described in the above specification for refining sugar, seems to us to be very ingenious, and we are inclined to think as well of it in every respect, as when we first noticed it in our 4th volume, present series, p. 319, in our remarks on the brevet or French patent, granted in May, 1808, to M. M. Derosne, who were the original authors of the invention. Since, however, in distilling the spirits from the coloured liquor that they have extracted from the sugar, a certain degree of waste and loss must occur, and as the process itself, must be attended besides with some expense, until the proportion of this waste, loss, and expense, to the value of

the benefit produced, be accurately ascertained, and laid before the public, it will be impossible to determine the economical result of the invention, in a commercial point of view; which alone can be considered when it is made an object of temporary monopoly.

We have likewise to remark, that an important impediment to the process in this country may be expected to arise from the interference of the officers of excise, who are not likely to permit spirits to be distilled or rectified, from any materials, or under any modification, however plausible may be the pretence, without their usual vexatious interference. [*Repertory.*

LIST OF AMERICAN PATENTS GRANTED IN JULY, 1828. *With Remarks by the Editor.*

Improvement in medicine; John Dent, M. D., Augusta, Georgia, July 2.

The medicine patented, is a compound forming Antibilious Pills, which, it is stated, have been proved, after long experience, to possess properties which render them more valuable than any of those before in use. They are prepared by Turpin and D'Antignac, of Augusta.

Improvement in the machine patented by Amasa Miller, February 18, 1826, for a method of constructing ways for drawing up vessels, and of applying the power in doing the same. Amasa Miller, New London, Connecticut, July 7.*

The advantages claimed by the patentee, are the removal of the ways from under the vessel, after she is hauled up, and the facility of replacing them when the vessel is to be launched, without lifting her from the position she is in; the using of a groove in the ways, as a substitute for ribands; there being iron cogs on the bottom of the cradle, which slide in the grooves on the tops of the ways; the economy with which repairs can be effected, and the small depth of water requisite for using the ways.

The improvement claimed in the present patent, are, 1st. Applying the power to the cradle, instead of swifting the vessel; and in this way entirely removing all strain, from the vessel, to the cradle.

2nd. The using keys, instead of braces, to secure the upper poppets.

3d. Having the cradle in two thicknesses, instead of using two sets.

An improved wind wheel, for grinding grain, and for pumping; Abner Murray, Athens, Bradford County, Penn., July 8.

This is a vertical wind-mill, with sails made of wood, tin, or sheet-iron, the wheel about 20 feet in diameter, the sails to be from 4 to

* By an oversight, the notice inserted p. 133, of the last number, was supposed to refer to the marine rail-ways, constructed by John H. Green, of New-London, instead of to the above. Of the comparative merits of the two we are not informed.

8 in number, and set at an angle of two and a half degrees. The shaft turns an iron wheel of 2 feet in diameter, and this, two pinions of 8 inches diameter, each of which carries a burr stone for grinding, of 14 inches in diameter. Each pair of stones stand vertically, one of them has a concave, and the other a convex surface. The stationary stone to have a hole in it, one and a half inches from the centre, to let the grain through.

When used for pumping, there is to be a crank to give a nine inch stroke to the piston.

The description of this machine is general, the patentee not informing us whether he claims the whole arrangement, or some particular parts only.

Improved manner of applying and attaching connecting pipes, or tubes, to the boilers of steam engines; Gideon Freeborn, New York, July 8.

The specification is as follows:

"The pipes are attached to the boilers, by bolts passing through the boilers to be connected, and lengthwise through the pipes. The bolts have a head on one end, and a nut and screw on the other end, or a nut and screw on each end, by means of which the boilers are brought in close contact with the ends of the pipes, and the whole held firmly together."

"Pipes put in, in this manner, can be cleaned or repaired with less difficulty than in any other."

Improved machine for dressing and jointing staves; Levi Benton, Hanover, Chataque County, New York, July 12.

This machine we shall hereafter describe at large.

A self-adjusting spring fastening for window-blinds, and shutters; Holly Seely, Unadilla, Otsego County, New York, July 14.

This is a kind of spring latch, consisting of a strap of steel, about 6 inches long, let into the under edge of the lower rail of a blind, or shutter, with a catch upon the window sill, and another on the wall, to secure it, whether open or shut. The end of the spring is bent so as to form a thumb piece, projecting inwards, to raise the spring, and open the shutter.

Contrivances for this purpose have become as numerous as sash-fastenings, ploughs, and washing machines, and in many of these the differences are so small, as *not to be seen by the naked eye*. If, however, they supply the wants of the patentee, and of the public, we shall not undertake the invidious task of interfering with either.

A machine denominated the rotary washer; Calvin Post, Spring-Port, Cayuga County, New York, July 15.

There is a cylinder of about 6 inches in diameter extending across the washing tub, or trough. This cylinder is fluted, and is made to revolve by means of a crank; above this, there is a second plain cylinder, having vertical play in its gudgeons; or else a hollow piece,

suspended as a rubber, and capable of playing vertically. The articles to be washed are allowed to pass between them, they being held, and turned about by the hand.

It is proposed to add a fly wheel to the cylinder, and sometimes to turn it by means of a treadle and pitman.

This machine has the merit of differing more than usual, both in its form and action, from most of its predecessors, but few of which have been sufficiently long lived to be introduced into society; we shall be happy to hear that this last born of the family is more fortunate. The only washing machine which appears to have received continued approbation, has been the simple, flat board, with flutes, or rollers, against which the clothes are rubbed.

A machine called the Longimeter, for the purpose of measuring a ship's way at sea; Abel Bayrd, South Reading, Middlesex County, Massachusetts, July 16.

The principle upon which this machine operates, is similar to that of Gould's Sea Log, invented about twenty-five years ago, and patented both in this country, and in England; and which was found to keep a ship's way with great accuracy. Gould's log consisted, mainly, of a spiral wheel, turning upon its axis by being drawn through the water. It was thrown over the stern of the vessel, and a line passed from it into the cabin; the revolution of the wheel, turned the line, which moved a train of wheels and indexes in the cabin. Many captains used, and approved it, and, we believe, that it was laid aside, principally, in consequence of the brass spiral wheel being frequently seized, and torn away, by sharks. Mr. Bayrd, has adopted a similar wheel, but instead of towing it astern, a water tight trunk is made to pass down through the hold of the vessel and into the water alongside of the keel. The spiral wheel, properly fixed to a frame, is made to slide down this trunk, so as to be exposed to the action of the water below the vessel. A rod, or pitman, moved by a crank, or eccentric wheel, on the shaft of the water wheel, extends upwards, and by means of levers and ratchet wheels, gives motion to indexes intended to show the vessel's way.

"The dimensions of the water wheel are, four inches length of cylinder; two inches its diameter; six inches length of axle; two inches depth, or width, of the wings, floats, or buckets; half an inch crank motion of the eccentric drum."

A machine for manufacturing paper in the sheet, by the dipping process; Marsden Haddock, New York, he having resided two years in the United States, July 17.

There is a horizontal shaft, or cylinder, on which there are fixed stumps or lifters, which give motion to seven levers, and these govern the principal operations of the whole apparatus. The mould and deacle perform their proper evolutions at the vat by means of one of them, and the others in regular succession complete the process. The paper is delivered from the mould on to an endless felt, is immediately carried under the press, which descends upon it, whilst another

is deposited ready to undergo the same operation; the pressed sheet is then carried on as the new one takes its place, and is removed by hand, to the drying room.

In the model, deposited in the patent office, the whole of the motions appear to be well performed, by means which are both ingenious, and simple.

Improved application of power to the common pump; Noah Underwood, Baltimore County, Maryland, July 17.

The power proposed to be employed is that of a dog, or other animal; the main object, it is believed, is to raise water for cattle, &c., upon plantations where it is needed. The dog is placed in a hollow drum, or wheel, like the turn-spit dog in former days; the wheel, of course, must be large to increase the leverage. A crank upon the shaft of the wheel, is connected to the pump handle, by means of a jointed rod, or pitman. It is the application of this jointed rod which the patentee claims, as having first applied it to the purpose stated.

A machine for thrashing, or clearing grain, from the straw of rice, and other substances; Asa Nourse, Beaufort, South Carolina, July 19.

This thrashing machine resembles, in its form, the common grist mill, but instead of stones, there are two thick framed wooden wheels; these lie horizontally, the lower one, which is 7 feet in diameter, being made to turn by a spindle, which passes through a large eye, or opening, in the upper one, which eye is 34 inches in diameter. The faces of these wheels are furnished with strips of iron, forming ridges which raise ¼ inch above their surfaces. These strips radiate from the centre, but do not coincide, those upon the upper wheel varying 3 degrees from the centre. The sheaves are put in at the eye of the upper wheel, and the grain is delivered at an opening in the rim. There are some other appendages, as knives for cutting the bands, &c.; but the parts described are the principal.

Improving and facilitating the means of transport, and conveyance of goods and passengers; John I. Reekers, Baltimore, Maryland, July 21.

The specification states, that "this invention or improvement, consists in covering the whole surface on which the transport is to be made, with sheets of iron, or other metal, or composition of metals, or ore, of the requisite thickness, by fixing them on the road, or way, in ready made plates, slabs, or pieces; or by spreading the smelted metals, or ores, over the whole extent of road, or surface intended to be used."

Such a road, it is suggested, may become a substitute for railroads, canals, and common roads. How the *plates*, *slabs*, or *pieces*, are to be fixed and secured, upon a foundation of sand, clay, and soil, we are not informed; but must presume, that the patentee has a clear idea of these things in his own mind: we are still more at a loss, to perceive how he intends to *spread the smelted metals, or ores,*

over the whole extent of the road. Should he think proper to favour us with clear views upon these points, we shall be happy to lay them before the readers of our Journal.

A machine called the 'universal drub,' for thrashing, or separating, by rubbing, the seed or kernel of all kinds of grain from the straw; Samson Felton, Killbuck township, Holmes County, Ohio, July 22.

The grain is placed upon an apron, and is carried between a cylinder, and a case where the seed is rubbed out. The cylinder is of metal, punched from the inside, like a grater. The case is perforated with holes, through which the seed passes, whilst the straw is carried off, and delivered from another part of the machine. The patentee claims, 1st. The simultaneous revolving and vibrating motion of the roller and case, producing the necessary rubbing.

2nd. The mode of increasing the vibration when the grain is damp, and *vice versa.*

3d. The general arrangement as it contributes to these ends.

A machine for manufacturing siding lath, and other lumber; Levi Rice, Lockport, Niagara County, New York, July 23.

A stock is fixed in a frame, in which it slides freely backward and forward. It is moved by a cog wheel, which works in cogs on one side of the stock, in the manner of a rack and pinion. A knife is fixed upon the stock, and the timber to be cut into laths, &c. is fixed in a frame and is made to bear against the stock, and the lath is cut by the traversing motion of the stock. The knife, it is said, may have a double edge, so as to cut a lath both by the forward and backward stroke.

A self-acting press for pressing cheese, &c.; David Hitchcock, of New York, and Chester Stone, of New Haven County, Connecticut, July 24.

This invention we intend hereafter to give, with the engravings which are requisite to make it properly understood.

Cloth for the boots of stages, and other purposes; Peter Laporte, Augusta County, Virginia, July 28.

This cloth is composed of hemp and wire, the hemp being twisted lightly round the wire, and the whole then woven in the manner of common cloth. This is to be covered with paint, and it is proposed, to use it for boots of stages, for carpeting, sacking-bottoms, pannels, bodies, and tops of carriages, &c.

Machine for feeding cotton-gins with seed cotton; Joseph Eubank, jun., Glasgow, Barren County, Kentucky, July 29.

To feed the cotton gin, for the purpose of cleaning the cotton from the seed, there is to be a feed apron, similar to that used in the machine for carding; this apron is carried forward with the requisite velocity, and at the end towards the saws, there is a roller, or cylinder, extending across the whole width of the apron. This cylinder is set with teeth, or fangs, formed of iron wire, and is made to re-

volve so as to feed the saws, by carrying the seed from the apron against them.

An improved corn-shelling machine; Philip Grosjean, Louisville, Kentucky. He having resided two years in the United States. July 29.

This shelling machine resembles that of Evans, as is acknowledged in the specification; that is, there is a vertical wheel, with ridges, or teeth, against which the corn is to be borne by a spring. The patentee proposes to give greater velocity to the wheel than in the former machine, the cog wheel and pinion intended to effect this, being to each other as 18 to 4. This wheel and pinion are fixed in a frame, attached to, but distinct from, that of the shelling wheel. The increased velocity, and the distinct frame, are the improvements claimed.

Improvement in the steam distillery; Thomas Lawes, and Philip Grosjean, Louisville, Kentucky, July 30.

The particular arrangement of the pipes, worms, tubs, flues, &c., described by the patentees, cannot be clearly explained without the drawings; and the specification does not seem to us, to point out distinctly, in what the particular improvements claimed, consist.

Making hammers of cast iron; Thomas Jones, Glastonbury, Hartford County, Connecticut, July 31.

In preparing to cast the hammers, a piece of iron is moulded with the pattern, against which iron the face of the cast hammer is run, and is consequently chilled and hardened. A small piece is also placed in the mould to come in contact with the claw. The hammers, after being cast, are to be ground, and polished upon a buff.

Improvement upon Phineas Slayton's machine for sawing hoops, lath, basket stuff, stuff for making riddles, window curtains, and window blinds; Nicholas Bratt, of Lockport, New York, July 31.

The stuff is to be sawed out by gangs of circular saws, fixed upon spindles, at suitable distances from each other. The manner of gearing adopted by the patentee, it is unnecessary to explain; the principal novelty in it, appears to us, to be the using of two drums on opposite sides of the shaft or spindle which carries the circular saws; instead of one broad, there are several narrow straps passing over the spindle from each drum, and the friction is said to be lessened, and other advantages gained, by this arrangement.

LIST OF FRENCH PATENTS

Granted by the French Government, from 1st of July, to 30th September, 1827.

To Paret, Pierre Joseph, mechanic, of Montpellier, for new weighing machines—15 years.

To Landrieu, Jean Baptiste Joseph, son & Co. of Anzin, for improvements in making bricks—5 years.

To Roland de Bussy, Jean François, of Paris, for a kiln for carbonizing peat or turf—10 years.

To Moussier, Rene Louis, toyman, Paris, for a sulphuretted diamond cut file, for taking away corns and bunions—5 years.

To Carpentier, Parfait-Modeste, Paris, for a mechanical bed and arm-chair upon springs, for sick people—15 years.

To Berry, Henry, merchant, London, for an elastic cork, made of *caoutchouc*, or Indian gum, and for certain improvements in the combination of, and application of, an apparatus for procuring instantaneous light—10 years.

To Ferry, Jean Nicholas, locksmith, of Epinal, Vosges, for improvements in the portative scales, by Quinteriz—5 years.

To Ensgraber, Leopold, Cooper and Brewer, of Channy, for a cooling ventilator—5 years.

To Jamin, Louis François, and Cordier, François Romi, button makers, Paris, for the invention and application of dyed leather of all colours for making buttons—5 years.

To Gamvin, Archange, of Paris, for a method of obtaining steam without fear of explosion, with great reduction in space, weight, and expense—15 years.

To Lagrange, Louis Benjamin, merchant, Paris, for a method of clarifying liquor—10 years.

To Pradel, Pierre, clock-maker, of Carcassonne, Aude, for a machine for shearing cloths—10 years.

To Jolly, Victor, and Ewbank, Bruno, chemists, at la Glacier, for a process for carbonizing turf—5 years.

To Mullens, Paris, for an elastic mattrass, and other furniture—15 years.

To Gurzot, Louis, architect, Paris, for a crane for removing the earth out of canals, &c. and for supplying it where wanted, for fortifications—15 years.

To Lesgent, junior, pewter pot maker, Paris, for the invention of a metal mixed with steel, for making spoons, &c. and possessing all the strength, elasticity, and polish of silver—10 years.

To Rey, Etienne, drawing master, of Lyons, and Aguettant, Sebastian, architect, of la Guillotiere, Rhone, for the application of the force of water, wind, and steam, in erecting bridges and other works—10 years.

To Munch, Jean Philippe Geoffroi, saddler and coach maker, Strasbourg, for a carriage, which it is impossible to upset—5 years.

To Napier, Charles, captain in the English Navy, and Polonceau, Antoine Rimi, Versailles, engineer, for a system of floating bars, for the navigation of rivers—10 years.

To Revon, Pierre, mechanic, Paris, for the invention of a steam engine, adapted to carriages and boats of all kinds and dimensions—10 years.

To Girard, Jean Joseph, locksmith, of Bagnols, Gard, for a cotton spinning machine—5 years.

To Bouchet Roudier, Jean, merchant, Nismes, Gard, for a method

of working, by a combination of levers, set in movement by manual labour, a variety of machines, in cotton spinning manufactories, mills, &c.—5 years.

To Tourmer, Miss Francoise Pauline, milliner, Paris, for rolls worn round the heads of children, made of whalebone, and called *Bonnelets Hijgieniques*—5 years.

To Decrouan, Michel François Denis, engraver, Paris, for a method of engraving upon linen, called *Tableaux Chalchographies*—5 years.

To Guerin de Fouein & Co. Paris, for an economical method of producing sulphuric acid—15 years.

To Hany, Guillaume, Boulogne-sur-mer, for the invention of one or more cylinders, to be adapted to atmospheric and condensing steam engines—15 years.

To Lepine, Paris, for a new invented lamp, and incombustible wick—5 years.

To Revillon, Thomas, Macon, for a wine press, acting by means of a pendulum, and for the application of the pendulum to mechanics—15 years.

To Penot, Jean Henri Achille, professor of chemistry, of Mulhause, Upper Rhine, for a method of obtaining sub-carbonate, acetate, nitrate, and hydro-chlorate of lead—15 years.

To Peyron, Jean Louis, and Augier, Louis Andre, merchants, of Montelimer, Drome, for a machine for thrashing and winnowing grain —10 years.

To Gervais, Paris, for a method of improving wines, brandies, and other spiritous liquors, by means of heat—10 years.

To Bouche, Dennis Joseph, Paris, for a machine for dressing cloth and other stuffs—10 years.

To Vallon, Pierre, cutler, Paris, for an artificial whet-stone, for sharpening razors—5 years.

To Martin, Ferdinand, surgeon, Paris, for a mechanical elastic bed for extending the spine or vertebral column—5 years.

To Vieville de Clanlieux, Paris, for a combing machine—15 years.

To Adam, Jaques François, Paris, for a moveable binding, adapted to public and other registers—10 years.

To Carswell, Messrs. Alexander and Robert, Greenworth, Scotland, for improvements in the building of vessels moved by machinery acting upon water—15 years.

To Berthault, Claude Jean Baptiste Alexandre, engineer, Chalons, for the invention of water proof cement—15 years.

To Pebezis, Pierre Jacques, geographical engineer, Paris, for the invention of an easy bed or bathing tub, called *baignoires dormeuses* —10 years.

To Poulliot, Jean Jerome, Paris, for a pneumatic regulator, adapted to hydrogen gas apparatus—5 years.

To Pepigne, Antoine, Paris, for a filtering machine—10 years.

[TO BE CONTINUED.]

The second article on the luminous appearance of the ocean, referred to in page 164, has been mislaid.

THE

FRANKLIN JOURNAL,

AND

AMERICAN MECHANICS' MAGAZINE;

DEVOTED TO THE

USEFUL ARTS, INTERNAL IMPROVEMENTS, GENERAL SCIENCE,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

OCTOBER, 1828.

Directions for bending, blowing, and cutting of Glass, for chemical and other purposes. Extracted from Chemical Manipulation. By Michael Faraday, F. R. S.

[Continued from p. 150.]

37. The information given relative to glass-blowing, will enable the student to make much of the apparatus already referred to. Tube retorts are made, by first closing the end of a piece of tube, and then the parts representing the body and the neck, are to be separated by a bend more or less sharp, according to the intended application of the vessel. In the same manner are the tubes necessary for the condensation of gases, to be made. Syphons are made merely by bending glass tube; or, if their apertures are to be contracted, the proceeding is the same as that necessary in the first part of the process for closing a tube, (30) the operation being carried no farther than to lessen the diameter: that done, the glass is to be allowed to cool, and the narrow part is then to be cut by a file. (19)

38. If when the glass tube is heated all round and much softened, the parts be pulled asunder quickly, and not in the guarded manner already advised, then, instead of a mere contraction of a small portion of the tube to two-thirds or one-half its first diameter, it will become extended and capillary; and the two portions of the tube held by the fingers, thus connected, will be found to contract in diameter for the space of half an inch, or an inch, gradually becoming capillary. This operation is frequently useful in the preparation of capillary tubes for various purposes, as in the contraction and elongation of the ends of glass retorts, or other similar apparatus; and in making tube funnels, syringes, &c. It should always be performed in the

air, and not in the flame of the lamp, unless the operator be very expert: when the glass, therefore, is heated, it is to be removed from the flame and drawn out. The greater the heated portion of glass, the longer will be the tube. Its length and fineness also increase with the rapidity with which it is drawn, and with the temperature given to it in the first instance. The velocity with which the hands should separate, is most generally, at the rate of about a foot in a second. The thickness, length, and general character of the capillary tube produced, is, also, considerably dependant on the kind of tube out of which it is made: the relation of the diameter to the thickness of the glass, will be nearly the same in the tube, both before and after it is drawn out.

39. When a contracted tube is required, and too long to be made at once, then having drawn one length, the original tube is again to be heated so near to the part already drawn, that when extended, only a little swelling or bulb may intervene between the capillary portions. It is not safe to endeavour to heat the tube so near to the already extended part, as, on drawing it out, to make one tube with the latter, without irregularity, for, owing to its delicacy, the previously extended part will almost certainly give way: no difficulty occurs in afterwards softening and drawing down the small expansions; for by making use of a little spirit-lamp flame, placed under the bulbs, they are soon raised to a red heat, and then by careful management are easily drawn down.

40. When the ends of retorts or other tube apparatus are to be thus reduced in diameter, they should not be drawn out more than is necessary, but left with sufficient strength to resist the slight mechanical accidents to which they are liable in the course of experiments. The same remark applies to such vessels as the small receivers or retainers, recommended. If the neck of the retort, or tube, to be drawn out be thin, it is for the same reason advantageous to thicken the part before it is extended, (35) for which purpose the glass must be softened in the flame, and retained at a high temperature for some time, and rather thrust together than pulled out; in this manner the thickness of the glass may be nearly doubled, and, consequently, the capillary tube resulting from its linear extension, rendered stronger.

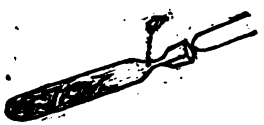
41. When capillary tubes are drawn for air-gauges, several should be made of different diameters, thicknesses, and lengths, and the most advantageous afterwards selected.

42. The same proceeding, with slight variations, is sufficient for the production of several kinds of useful apparatus. A tube funnel is made by elongating a piece of tube in this manner, at about an inch from the end, and then separating it, leaving the short piece with so much of the capillary tube attached to it, as will form a funnel of sufficient length. Tube syringes of various kinds, for the removal of azotâne, washing of precipitates, &c. are made with equal facility. When the end of a piece of tube is heated and drawn out, a form more or less acute may be given to the termination, which, being cut so as to leave an aperture of the proper size, is only to be

held for a moment in the flame to soften and obliterate the edges, (20) and a very good syringe body is formed. A little tow, wrapped round the end of a wire, and moistened, forms an effectual piston, and thus an instrument of great use in numerous operations, is quickly made. If it be required that the termination of the syringe should pass off obliquely, it is effected by drawing out the tube in that direction when hot.

43. It is very frequently necessary with tube apparatus, to seal apertures hermetically, so as entirely to close the vessel, and make it continuous in every part. This process resembles that by which one end of an open tube is sealed, (36) so far as regards softening the glass, bringing it together, contracting the aperture, and, ultimately, closing it; but it differs very much in other circumstances, dependant upon the state of the interior of the vessel. In the open tube, the glass is equally pressed on both sides; but that is rarely the case in the closed tube, a tendency of the contents to pass outwards, or of the air inwards, almost always occurring.

44. The simplest case of the kind is, where solid fixed matter is to be confined in a tube for the purpose of preserving it. The included substance then sends off no vapour, and all that is to be guarded against, is, the expansion and contraction of the air within, by the variations of heat. Suppose the tube closed at one extremity, and that one-half or two-thirds of it is filled with the substance; care should be taken that the latter does not rise so near to the upper part of the tube as to be affected by the heat, especially if it be an easily fusible or changeable body. The top of the tube when brought towards the flame, should be inclined, (36) that the products of the combustion may not enter it; and the bottom should be inclined downwards, that the contents may not fall towards the heated part. The upper part, being heated, should be drawn out and contracted, precisely as if it were the end of an open tube that was to be closed, except that the glass generally should be retained as thick (35) as it will be required when finished, in order that the capillary tube may be of considerable comparative thickness, and that an aperture for the air through the middle of it may be preserved the whole time. The wood-cut will illustrate this state of the tube. No difficulty will be found in directing the heat about *a*, in drawing off the end piece, and in leaving the tube sealed, for the glass will readily coalesce at the moment of separation; but the object is, to make this end as strong as any other part of the tube, and of a form similar to that of the opposite extremity; for effecting this, the following explanations and precautions will be found useful.



45. Supposing the piece drawn off and the end closed; the glass is so hot and soft at the moment, that, if from an accidental contact of the flame, any part of the tube become hotter than before, the air within will expand, the glass will be blown out into a thin bubble, which, breaking even by the mere pressure of the atmosphere as the tube cools, will leave a large hole. It will now be more difficult to

close the tube than before the extremity was removed, for the sides of the aperture must again be collected together and drawn off, and a capillary neck again formed.

This may be avoided by purposely heating the upper part of the tube before sealing it hermetically, so as to expand and expel the air from within; then, removing the flame and applying it to the capillary neck as the general temperature of the tube sinks, the piece is to be drawn off, and the aperture sealed, and as the pressure is inwards, rather than outwards, the glass will be pressed in the former direction. This is, in fact, the method to seal the tube strongly, and to make it of a desirable shape, but it is subject to an accident, which to be avoided must be known. If the glass at the end has been left thin, and it be heated until perfectly soft, the pressure of the external air will frequently force it inwards, sometimes into a decided bubble, or sometimes into various wrinkled and irregular forms, which, when cold, are almost sure to crack in numerous directions.

These accidents are avoided by making the end of the glass and the capillary neck of considerable comparative thickness, which is done by allowing the glass to gather itself up when in a fluid state, (35, 40) and also when warming the tube to expel a part of the air, by not raising the temperature too much; then, upon proceeding to soften the neck and seal the extremity, the flame should be directed rather generally to that end of the tube in such a manner that, the whole being softened, the apex shall still be retained at the highest temperature. In this way it will be easy, by a little practice, to make the external pressure effectual in forcing in the end of the glass generally, and causing it to become altogether thicker and stronger, instead of having a small portion suddenly blown inwards, and the whole rendered irregular. Or if, by too long a continuance of heat, the air within begins to expand, still, as all the glass at the end is of equal softness, the whole will gradually enlarge outwards; an effect which will be immediately perceived, and the operation may be stopped before any injury is occasioned.

46. When the tube contains a fluid instead of a solid body, the care required is greater, and must be proportionate to the volatility of the substance. A fixed fluid, if alone, merely requires to be retained in the lower and colder part of the tube, away from the end to be sealed. Sudden motion should be avoided, lest drops be thrown upon the heated part, and cracks be occasioned: during cooling, the tube should also be placed steadily with its heated end uppermost. There are particular cases, in which great care is necessary, to prevent disturbance of the contents of the tube. Such are the experiments upon the condensation of gases, in which the strength, uniformity, and annealed state of the end hermetically sealed, are essentially necessary.

47. If the substances to be confined are volatile, but yet, like alcohol, ether, chloride of sulphur, &c. have their boiling points not lower than 100° or 150°, then additional precautions will be needful: these apply particularly to the moment when the capillary neck is to be finally drawn off and closed, and the end thickened and made

strong. The effect of heat upon tubes with such contents, is not only to expand the air within them, but also to increase its bulk, by raising and mixing with it the vapour of the substance. The formation of this vapour, and, consequently, the tendency of the gaseous matter within to expand, is not simply in proportion to the heat of the end of the glass tube with which the vapour is in contact, but depends also upon the heat communicated to the fluid beneath. This effect is produced more slowly than the former, and may, in the hands of an inexperienced person, lead to confusion. The temperature of the glass near the end may be actually falling, and may lead to the expectation of a diminution in bulk of the gaseous or vaporous matter within, and, consequently, of a pressure from without, inwards, whilst, at the same time, the temperature of the fluid may be rising by *contact* with the neighbouring hot or warm glass, and may cause an increase in the quantity of vapour given off, and upon the whole, a tendency of gaseous matter to pass out of the tube; which, not being anticipated, would spoil an experiment. In these cases, the upper part of the glass (45) should be heated so as to expand the gaseous contents a little, and at the moment the capillary neck is drawn off, and the aperture closed, a piece of moistened bibulous paper should be applied round the part of the tube containing the fluid, and if the substance be very volatile, even a little higher up, though not to the heated part of the glass. This will prevent any further elevation of temperature in the fluid, and the end may be safely heated and thickened, (45) in the manner already described for tubes containing solid bodies.

48. When the aperture to be sealed is small, and at the end of a capillary tube, nothing more is required than to hold it in the flame of a lamp or candle, when the glass will fuse and coalesce. Or if the end be broken and rather wide, the part softened by heat should be touched with another piece of glass, and be drawn out and sealed as before. In these cases when sealed, the glass is to be removed from the flame, not being suffered to run into a little ball, which will generally break off when cold, or after an interval of three or four days.

49. When substances so volatile as to boil almost at common temperatures are to be sealed up, the tubes containing them must be cooled by refrigerating mixtures. If the fluids are to be preserved as specimens, the capillary neck should be of considerable thickness, and when effectually sealed, whilst the tube is in the frigorific mixture, should not afterwards be altered, nor should any attempt be made to give it more thickness, or a better form. A spirit-lamp and mouth blow-pipe is more convenient for softening the capillary necks, and sealing these tubes, than the table blow-pipe.

50. When the object is merely to close the ends of capillary tubes, it is easily effected, the tubes being cooled at the same time. When the fluids are of such volatility as to cause only a feeble stream of vapour from the aperture of the vessel, (and several such may be found amongst the substances held in vapour in oil gas,) the cohesive force of glass is sufficient to cause it to run together when softened,

and to seal the orifice, even though there be a slight pressure outwards. For this purpose the end of the capillary tube is to be introduced into the flame, and being touched with another piece of glass, the extremity is to be drawn off, and, at the same time, sealed: at the instant of doing this, it is to be removed from the flame, that it may cool and solidify, lest the heat of the lamp or hand should increase the tension of the vapour, and cause such pressure outwards as would be sufficient to expand the soft glass.

51. The process of sealing tubes hermetically, which have previously been exhausted of air, requires certain precautions to prevent the pressure of the atmosphere from either making an entrance, or forcing in the glass. Suppose it were necessary to enclose some camphor, hermetically, in a tube exhausted of air, that certain of its habitudes as to vaporization and crystallization under such circumstances might be observed. A tube of sufficient length is to be selected, and being closed at one end, the camphor is to be introduced; the tube should then be heated at about an inch from the open extremity, and should be contracted and thickened in the manner described, so that the smallest part may be about half an inch in length, about one-twelfth of an inch in internal diameter, and one-third of an inch in external diameter. A retort cap is to be cemented upon the open extremity, and a stop-cock attached to it. This being done, the tube is to be connected with the air-pump and exhausted, and the stop-cock being closed, the tube is to be removed from the pump in its exhausted state. The small flame of a spirit-lamp is now to be applied to the middle of the capillary part, so as to heat it gradually all round; as the glass softens, the pressure of the atmosphere will make it collapse and become solid, the passage will be obliterated, and the tube will be converted into a rod. This done, the heat is to be applied more immediately to the middle of the solidified part, which, when it has become soft, is to be drawn asunder. No difficulty will be found in doing this, without letting in the smallest portion of air, and, if proof of the accuracy of the process be required, it may be obtained, to a certain degree, by plunging the piece attached to the stop-cock under water, and breaking off the point there; if the water should enter in such abundance as to fill this piece, it will show that no common air has entered by the stop-cock, and the appearances will sufficiently indicate whether air has entered or not at the part heated. No attempt should be made to thicken, or in any way bring into form, the sealed end of the exhausted tube; for the pressure of the air will be almost certain to force in the softened glass, unless the operator be very skilful.

[TO BE CONTINUED.]

An Essay on Calico Printing.

[Extracted from Parke's Chemical Essays.]

[CONTINUED FROM PAGE 175.

The manipulation of printing may be thus described. The workman taking the block containing the pattern in one hand, applies

it gently to the surface of the sieve, so that a sufficient quantity of the thickened mordant may adhere to the figures. When the block is thus charged, he applies it to the calico, and gives it a blow with a small mallet, either slightly or otherwise, according to the nature of the pattern.

This alternate application of the block to the sieve and to the calico, is continued until the workman has gone over the whole piece. In this way several different mordants are sometimes applied to the same piece of goods. This is, indeed, always necessary, when the finished piece is intended to contain a variety of colours, the different colours requiring different mordants to fix them and render them permanent.

The calico is now removed to a room called the stove, where a certain degree of heat is given to it by means of flues, which go round the room on the inside, near the floor. In this room it is generally continued for at least twenty-four hours.* The intention of this is, to evaporate the acids used in the preparation of the mordants, and which might otherwise injure the texture, and also to fix the base more surely within the fibres of the cloth.

Whenever acetate of alumina is printed as a mordant upon calico, it appears to me that the pieces ought not to go into the stove until the work has been first thoroughly dried in the open air, because it is well known that the earth of alumina is precipitated from a solution of this salt in a high temperature. I suspect this to be the cause of many of those disappointments which are perpetually occurring in the production of the various shades of yellow and madder reds.

In the operation of stoving, an attention to temperature is of the utmost importance. In general, the room is kept at about 90°; but an intelligent calico-printer varies this according to the nature of the work under operation.

It was formerly a practice to expose all those calicoes which were printed with the several mordants, to a hot stove, for the purpose of evaporating the acids and fixing the base with more certainty in the fibres of the cloth; but of late years a more convenient method has been adopted, which consists in passing the calicoes by means of machinery along a set of apparatus known by the name of *steam-chests*. These are large square cast-iron vessels fixed at some little distance from each other, sometimes on an inclined plane, and in other cases perpendicularly one above the other; these are kept constantly full of steam, and are connected with each other by bent pipes either of iron or lead. It is so contrived, that the pieces of calico are made to pass over each of these heated chests, in contact with their surfaces; and, in consequence of the access of atmospheric air, as they pass from one of these chests to the other, they are generally found to have become thoroughly dried by the time they have arrived at the end of the series. A better apparatus has, however,

* This is when common red-liquor has alone been printed; but if citric acid or strong muriate of tin has been employed, less time is sufficient, and for the latter seldom more than half an hour is allowed.

been lately invented, consisting of an arrangement of cylinders made of tinned iron or copper filled with steam, and round which the calico is made to pass in succession. In this apparatus there is a vane fixed underneath every two of these cylinders, which is moved by means of the steam-engine, and agitates the air so as very much to facilitate the drying process. This mode of drying printed calicoes is so effectual, that, although the cloth be wound, from a heap at one extremity of the apparatus, upon the first cylinder quite in a wet state, it becomes thoroughly dry by the time it has passed over the whole apparatus, and falls in a perfect state on the heap at the other extremity of the apparatus.

If iron-liquor has been employed in printing the goods, it is an excellent practice to keep them for several days exposed to the atmosphere* after their removal from the stove, as the blacks, pompadours, olives, and, indeed, every other colour prepared with that metal, will increase in intensity; the goods will clean better in the dung-vessels, as will be explained hereafter, and the colours will rise higher, and brighter, when they come into the copper of bark or madder.

It may be worth an experiment to discover whether the colours containing iron, would not be better if they were suffered to be only a *very short time* in the stove, but were hung up instead, for several days, exposed to a current of air at the temperature of the atmosphere; as the iron would thus acquire the oxygen slower, and, consequently, would be fixed more firmly in the fibres of the cloth.

When the pieces have been properly stoved, they are passed, by means of a winch, through water at various temperatures, with a little cow-dung mixed in it. The intention of the dung is, to absorb and remove that portion of the mordant which is not actually combined with the cloth, and which, otherwise, might stain the white or unprinted parts.

This part of the business was formerly conducted in a very uncleanly and negligent way; but of late years some printers have incurred a considerable expense in the construction of their dunging machines, with cocks for hot and cold water attached to them, and thermometers to regulate the temperature.

I suspect, however, that the dung of the cow is serviceable in another way, besides that of cleansing,† though few printers may be aware of the nature of its operation.—It is acknowledged that madder, cochineal, and some other dyes, produce much better colours on woollen than on cotton cloths, owing to the former being of animal, and the latter of vegetable origin. I presume, therefore, that the dung imparts an *animal* matter‡ to the fibres of the cotton, and

* The iron in an acetous solution is in the state of the *black* oxide; but by exposure to the air it acquires a further dose of oxygen, and obtains the state of the *red* or peroxide.

† To *cleanse* calicoes by immersion in a dung-vessel, may appear to be a strange phrase; but as this is the technical language of the trade, no other term could be employed with propriety.

‡ Berthollet, who analyzed the dung of the cow, found in it a substance partaking of the nature of animal *bile*.

that this animal matter acts as an additional mordant, and thus more powerfully attracts the colouring particles of the dye, than the mordants alone would be capable of doing.

If a piece of calico, prepared with the acetate of alumina, be divided into two parts, and the superfluous mordant removed from the one by cow-dung and water, and from the other by water only, at the same temperature, it will be found, on passing the two portions through a decoction of weld, or quercitron bark, that the yellow will be much more intense and bright in that which has been submitted to the action of the cow-dung.

The process of DUNGING calicoes, is an operation that varies in time, from five to forty minutes, according to the style of the work. The pieces are then taken to the river or wheel, to be more effectually washed; and after this, they are passed through tepid water, in order that the workman may be assured that every impurity is removed.

His next care is to provide a copper boiler of pure cold water, into which a sufficient quantity of madder is broken, and then a fire is lighted underneath the copper. The calicoes, printed and rinsed as above, are now put into the boiler, and from the time they are immersed, the workman never ceases to turn the winch, so as to pass every part of the goods repeatedly through the liquor, until the whole acquires a boiling heat. Indeed, this operation is sometimes continued for ten or fifteen minutes after the bath of madder actually boils, when the pieces are taken out and washed thoroughly. In most of the large calico-works, a considerable improvement in the method of maddering has been adopted. This consists in giving a perpetual motion to the calico by means of the steam-engine. The ends of several pieces are fastened together, and then they are put into constant motion through the madder-vessel, whereby the colours are rendered more uniform; and one man is enabled to attend to three dying-vessels at one time, which is found to be a great economy of labour.

Madder is one of the most valuable drugs we have, for a variety of purposes in dying and calico-printing, as it is the agent by which the best and most permanent blacks are produced; also the finest purples, and every shade of red, from a pale pink, to a crimson. But, perhaps, it may not be generally known that this article improves by age. For instance: if a quantity of madder-roots be ground, and then packed tight in a cask, so as to exclude the air, and kept thus for six months, they will dye a much better colour, and go much further, than they would have done had these roots been used as soon as they were ground.

The process which is called MADDERING, has the effect of imparting all the requisite colours to the goods, by means of *one* operation, which may be thus explained:

While one mordant precipitates the colouring matter of the madder to a red, another precipitates a different portion of it to a purple, another precipitates it black, and so of every possible shade, from a lilac to a black, and from a pink to a deep red.

If a portion of weld or bark be added to the madder, every shade from a brown to an orange may be produced; whereas, if weld or bark alone be employed, all colours between a dark olive and a bright lemon can be imparted to the cloth. These changes are all occasioned by the play of chemical affinities, for the knowledge of which we are indebted to the improved state of chemical science.

The only materials which are employed by the calico-printers for the production of fine yellow, are the quercitron bark and the weld plant; the former is the bark of a peculiar kind of oak growing in America,. the latter is the produce of our own country. The weld plant (the *reseda luteola* of Linnæus) is, for the most part, cultivated about Doncaster in Yorkshire. It is found, however, that nothing impoverishes the land so much; otherwise, it produces a very heavy and profitable crop.

Here it may be worth remarking, that, whenever it is of consequence to produce the finest yellows, or more delicate lemon colour, it is necessary to dry the pieces in the open air, as the stove would not fail to injure such colours; for stove-drying has always a tendency to convert a yellow to an orange. It is also necessary to be equally careful in the operation of dunging the mordants, for these pale yellows; for should this be done at a higher temperature than 96° or 100°, their beauty will certainly be impaired. There is another advantage in this, viz. by dunging at this low temperature, the dying may be completed even at 110° or thereabouts, which will give a much livelier colour than where a higher temperature has been employed.

The mordants generally used in calico-printing, are acetate of iron for browns, blacks, lilacs, &c.; and acetate of alumina for all the different shades of reds and yellows.

The best method that I am acquainted with, of preparing the acetate of iron for making the common black colour for calico-printing, is as follows:—Take the iron liquor of its full strength, or lowered with one or two waters, according to the goodness of this mordant, in the first instance, and then add about 2½ lbs. of flour to every gallon of the fluid, more or less, according to the goodness of the flour and the kind of work for which it may be designed. Having well incorporated the flour with the iron liquor, let the whole remain twelve hours, or more. After this, it is to be boiled for about half an hour, or till the whole be converted into a paste of due consistence, when it will be fit for use. The materials become better incorporated, and the colour is found to work better, by lying thus long before it is finished by boiling.

Formerly, the acetate of iron was made by digesting old iron hoops in sour beer, or in very weak vinegar; but, of late years, it has chiefly been made with the pyroligneous acid,* the oleaginous impurities of which tend, in some cases, to improve the mordant.

* If wood be submitted to an intense heat, when inclosed in an iron vessel of any kind with a proper aperture to allow the vapour to pass, this vapour, on being condensed, forms the acid in question, and is now known to be a kind of impure *vinegar*. The wood, in this case, is converted into *charcoal*, of which a great deal is prepared by this process, particularly for the formation of gunpowder.

Blacks are also produced by the nitrate of iron* and gallic acid; the mixture is called chemical black. The nitrate of iron, is made by dissolving metallic iron in a peculiar kind of aqua fortis. Common aqua fortis will not answer for this purpose; for, though it may dissolve the iron with rapidity, part of the metal is apt, very soon, to precipitate; which not only weakens the colour, but leaves the remainder so acidulous that there is always a danger of such a preparation injuring the texture of the cloth.

Chemical black is made by mixing a decoction of galls with the nitrate of iron just described; this produces gallate of iron, and, probably, some tannate of that metal: the disengaged nitrous acid then dissolves the two newly formed salts. The colour called chemical black, may, therefore, more properly be said to be a union of the colouring matter of galls, with the peroxide of iron, than a mixture of gallic acid with nitrate of iron. The gallic acid is, probably, like the pyroligneous, or, nothing but the acetous acid holding a peculiar vegetable substance in solution, and either the muriate or the sulphate of iron, if applied to cloth in conjunction with the colouring matter of galls, will, in time, produce as intense and durable a black, as the nitrate; but the difficulty of thickening the solutions of these salts, and the time which is required to convert their base into a peroxide, render them less fit for the calico-printer's purpose.

It is, however, necessary to remark, that the black which is formed by this solution of iron, is produced in a different way from blacks in general; for, when common iron liquor is used for this purpose, it is first printed on the calico; and when it has been sufficiently oxidized by exposure to the air, the goods are boiled in a decoction of madder, which renders such parts as had been printed with the acetate of iron, an intense black. But the black from nitrate of iron and galls, is applied at once to the cloth, and is not afterwards increased in intensity, or raised, as it is termed, by dying.

The calico-printer, by using a black ready formed, is thus enabled to mix it with other colours, in cases where, by dying alone, it could not be produced, as in conjunction with yellows and olives, raised by weld or quercitron bark.

The acetate of alumina is prepared by a mixture of the sulphate of alumina and potash, with acetate of lead, both in a state of solution; so that, on the theory of double decomposition, sulphate of lead is formed, which precipitates, while the acetate of alumina remains in solution.

Since the demand for this article has been increased, on account of the extension of the printing-trade, it has been prepared from the pyroligneous acid, by means of lime and alum. The following is the method:

The pyroligneous acid is first passed through a still, to divest it of a portion of the oil or tar which is always dissolved in it; it is then

* Nitrate of iron was not applied to calico-printing till within the last fifty years. This discovery formed an important æra in the trade, as it afforded the manufacturer the means of varying his styles of work in a multiplicity of ways and forms, which till then were entirely unknown.

saturated with lime, or whiting; and, lastly, the acetate of lime thus formed, is decomposed by a heated solution of sulphate of alumina and potash. The result of this double decomposition, is sulphate of lime, which precipitates, and acetate of alumina, which is drawn from the sediment of the calcareous sulphate, and preserved for use.

And here it may be necessary to caution the manufacturer against a misfortune that may befall him, if he be not conversant with the chemical nature of the substances he employs.

Magnesian limestone abounds in Derbyshire and in some of the adjacent counties; and should a maker of acetate of alumina employ such lime in his process, the article which it would produce, would, in all probability, be entirely unfit for the use of the calico-printer. But I must be more explicit.

In employing the common lime, in conjunction with alum, a sulphate of lime will be formed; as mentioned above, and this being nearly an *insoluble* salt, will precipitate. But here, sulphate of magnesia would also be formed, which, being a *soluble* salt, would remain in solution, and increase the specific gravity of the liquor, a circumstance which would be very apt to occasion the deception which I am anxious should be avoided. If magnesian limestone be employed, the liquor will appear good by the hydrometer; but as it will contain more Epsom salt than acetate of alumina, it will be unfit for every purpose for which it was intended.

While speaking of acetate of alumina, I cannot avoid remarking, that the process which has just been described for making this mordant, and which is followed, invariably, by many of the manufacturers in the north, is extremely improper, on account of the lime which is employed in it, be the lime ever so good, as that earth is very prejudicial to every species of red dye. The proper way of making it, though more expensive, is that which was originally pointed out by Berthollet, and which consists in decomposing sulphate of alumina and potash (common alum) by means of saccharum saturni, or acetate of lead.

[TO BE CONTINUED.]

Sketches of the Progress of Inventions, connected with Navigable Canals. Compiled from various sources.

[From the Boston Journal of Science.]

(Continued from p. 193.)

There is a great variety in the size of locks, as the canal is navigated by large, or small boats. The sea lock, near Inverness, on the Caledonian canal, is 180 feet long, 40 feet wide, and 20 feet deep, besides the lift, or difference of the levels, of 8 feet. The locks on the Derby canal, are 90 feet long, 15 feet wide, and 11 feet deep, including the lift of 8 feet. Those on the Leeds and Liverpool canal, are 70 feet long, 15 feet wide, with 9 feet lifts. In passing a lock,

every ascending boat requires a quantity of water just sufficient to fill the lock from one level to the other, together with a quantity equal to the weight of the boat. But a descending boat expels a quantity of water into the upper canal as it enters the lock, which is retained by the upper gates; equal to the weight of the boat and its lading. To make a double passage then, or for two boats, equally loaded to pass in opposite directions, it requires a quantity of water equal to the area of the lock multiplied by double the lift. This may, perhaps, be taken without any great error, on locks of medium size, at 320 tons.* A necessary precaution in fixing the site of

* In a memoir on navigable canals, by M. Girard, in the "Annales de Chimie," and which Mr. Doolittle has translated and published in Silliman's Journal, vol. 4. p. 102, the expense of water by locks, is examined at some length, as follows:—"Does there not exist a necessary relation between the fall, the quantity of water expended for the passage of boats, and the draught of water of the boats which ascend or descend through the locks? This is a question, which, notwithstanding its importance, has never yet been treated, and which I propose to resolve. To reduce the question to its most simple expression, we shall suppose: 1st. That the boat is to pass from one level to another, by a single lock. 2d. That the boats are of a prismatic form, and that their dimensions are such, that the interval which separates their sides from the sides of the lock, when compared with the space occupied by the boat, may be neglected without sensible error.

"Let S, represent the horizontal section of the lock and the boat; x, the lift of the lock, that is, the difference of level between the two basins which it unites; t', the draught of water of a boat which ascends the lock; t'', the draught of water of a boat which descends.

"The manœuvre of passing a boat from a lower to a higher level, consists in first drawing the boat into the lock through the lower gate, which is closed when the boat is in; 2d. Introducing, no matter by what means, from the higher basin into the lock, a quantity of water sufficient to bring the two surfaces to the same level; 3d. Opening the upper gate of the lock, and passing the boat through into the upper basin. Hence we see that to effect this passage, and in order to raise the surface of the water in the lock to a level with that in the upper basin, it is necessary to draw from that basin a prism of water $= Sx$, whose base is equal to the horizontal section of the lock, and whose height is represented by the lift of the lock. Furthermore, when the boat passes from the lock into the basin, its place in the lock is necessarily supplied with a quantity of water $= St'$, equal to the volume of water which it displaces, and which flows from the basin into the lock.

"Thus the quantity of water expended in bringing things to their present state, may be expressed by $Sx + St'$. Let us suppose that, the communication remaining open between the upper basin and the lock, another boat is ready to descend, the manœuvre is reduced to 1st. introducing the boat into the lock and shutting the upper gate; 2d. emptying the lock until its surface is on a level with that of the lower basin, and 3d. opening the lower gate and passing the boat into the lower basin.

"The introduction of the boat from the upper basin into the lock, has caused a reflux from the lock into that basin, of a volume of water $= St''$, equal to that displaced by the boat. In letting off the water from the lock, to lower its surface to a level with that of the lower basin, things are replaced in the same state as they were before the ascent of the first boat.

"This operation, which we shall denominate *a double passage*, has caused an expenditure of water represented by

$$Sx - S(t'' - t') = Sy$$

since the quantity of water expended may always be represented by a prism,

locks, is to avoid placing them too near together, for in such case, the water let out of the upper lock on the passage of a boat, will overflow the banks of the subjacent level, and not only be lost, but be likely to injure the works. The locks should be all of equal height, so that the water used at the upper lock, or an equal quantity, may serve for the passage of the boats through the lower lifts.

A great many contrivances have been proposed, either as improvements of the common lock, or a substitute for it. If, in a lock of the common construction, we consider the water which is let down from one level to another, in the light of a force expended to produce a given effect, which is, the elevation or depression of the boat and its load, there is a loss of the acting force unknown in any other mechanical operation. Thus, to raise a boat and load weighing 30 tons, through 8 feet, it will, in general, require 180 tons of water, falling through an equal space. But, in descending boats, the effect is *negative*, and the disparity between this and the force, is yet more striking. If, therefore, in transferring boats from one level to another, the economy of force only were considered, the inclined plane, arranged as it is in England, must be very advantageous, the expense of force being in theory, merely the small sum required to overcome the friction of the machinery and the inertia of the moving masses.

Mr. Fulton, who paid much attention to this subject, in the early part of his life, says, "I do not hesitate to prognosticate the annihilation of lock canals by improved science, in like manner as improvements in machinery render the old apparatus useless." (Fulton on Canals, p. 28.) A bold prediction, which seems yet very far from being fulfilled. This gentleman was then highly in favour of the inclined plane as a substitute, not only for locks, but for aqueducts. In his work published in London in 1796, he has detailed, fully, his plans. His machinery, besides the inclined plane, may be described in general terms, as consisting of an endless chain running over wheels, fixed, one at the top and one at the bottom of the plane;

whose base is equal to the horizontal section of the lock, and whose height is represented by an indeterminate line y. Dividing this equation by the factor S, common to all its terms, it becomes

$$y = x \quad (t'' - t',)$$

which belongs to a right line of simple construction. It expresses, moreover, between the lift of the lock, the draught of water of the boat, and the quantity of water expended, relations which, notwithstanding their extreme simplicity, have not, hitherto, been remarked.

"It follows, from this equation, that the expense of water, y, will be positive, null, or negative, according as we have:

$$x > t'' - t'$$
$$x = t'' - t'$$
$$x < t'' - t'$$

Thus it appears, that the expense of water from any level, may not only be diminished at pleasure, but that it may be rendered null, and that a certain quantity of water may even be raised from a lower to an upper contiguous basin."

There is, perhaps, no instance on any canal, where $x < t'' - t'$, or even where $x = t'' - t'$. Still, however, the investigation may be extremely useful, as showing the relations which exist between the loads which pass through the canal, the lift of the locks, and the expense of water.

to this chain are to be attached two boats, in such a manner that the descending boat assists in dragging up the ascending one. The small force which may be necessary to pass the boats so arranged, over the plane, is to be supplied by a vessel of water descending through a shaft from the upper canal. The boats are to be small, and they are to be provided with wheels, to diminish the friction, in passing over the planes. Various other modifications of the inclined plane, have been proposed; some of which, as has been before observed, are advantageously used in peculiar situations. None of them, however, are thought, at the present time, likely to become a general substitute for the lock.

Another contrivance, called the balance lock, consists in floating the boat into a case or vessel, at the termination of one canal, and moving it vertically, by machinery, to the other canal. There are two of these cases suspended over the same pullies or axle, so that they at all times balance each other, and that, whether one or both contain boats; because they are so executed, that a boat on entering, expels from the case a quantity of water equal to its own weight, and the same quantity returns to the case when the boat is passed out. But one of the most ingenious machines which has been invented to avoid the loss of water, is described in the Repertory of Arts, vol. 1, p. 81, 1st series. It may, perhaps, be considered as a modification of balance locks, previously invented; still it exhibits great originality and inventive power in its authors. It is necessary in this, as in other balance locks, that the two canals terminate in the same vertical plane; the end of the upper canal being closed, by gates, at its termination. Things being in this state, a well or pit is sunk at the head of the lower canal, of a depth somewhat exceeding the difference of elevation between the two levels. This pit is filled with water, and a diving chest or buoy, sufficiently strong to bear a heavy external pressure, is then made and put afloat over the pit. On the top of this chest several strong posts are erected, high enough to reach the bottom of the upper canal. These posts support a cradle, which is open above and nearly filled with water, and having gates at both ends, through which the boat may pass in and out. The specific gravity of the buoy, must be so much less than that of its surrounding water, as to be just able to support the load, consisting of the pillars and cradle, which are fixed to it, together with the canal boat and a sufficient quantity of water to keep it afloat in the cradle. When so loaded, it should be just covered by the water in the pit, where it can now move up and down, on the application of a very small force, like the balloon, or the Cartesian Devil. To let down a boat from the upper level, the end of the cradle is fixed by screws to the gateway of the canal, the gates of which, as also those of the cradle at the end next to the boat, are then opened; the boat enters from the canal into the cradle, displacing a quantity of water just equal to its weight, consequently, the burden on the buoy is not altered. All the gates are then closed, and the fastenings, which confined the cradle to the gateway, taken off; when, on the application of a trifling force to the mass, the buoy descends to the bottom

of the pit, bringing the boat to the plane of the lower level. The gates in the end of the cradle are then opened, and the boat passing out, its place is supplied by water from the lower canal.

There is yet another contrivance (Rep. vol. 2. p. 235,) differing considerably from the above, although of the same class. It is a caisson or diving-trunk, made so as to be perfectly tight when the gates at its ends, are closed. This floats in the lock between the two canals. The canal boat is received into it, and it is made to descend, through the water of the lock, to the plane of the lower canal; when by opening the end of the caisson, and corresponding gates in the lower part of the wall of the lock, the boat is passed out. The ascending motion is obtained by pumping water out of the caisson, which operation is reversed, to obtain a descent. In this and the preceding invention, the manner of passing an ascending boat will be understood, from the operation of descending, which has been described.

In another and distinct class of contrivances, it is proposed to fill the common lock, by elevating water from a sort of cistern, made near it. To accomplish this, different kinds of plungers are to be used, some of which are very ingenious, particularly those of Betancourt, Steevens, Busby, and Bogaerts. In these, the plungers are so counterbalanced, as to be always in equilibrio with the water in the lock, at whatever height it may be; consequently, the application of a very small force, destroying the equilibrium, produces the rise or fall of the water, as may be required.

Although some of the preceding machines have been erected on the large scale, and have given promise of success, they have not made their way to public confidence, and have, in the end, been generally abandoned. We have thought, however, that it might be useful to recapitulate some of the inventions connected with so important a subject: several of these show, that their authors were well acquainted with the laws of fluids, and that they pursued their designs with sufficient ardour to have conquered any small difficulties.

We have omitted mentioning before, an ancient and very obvious method, because it has been often used, and found to answer its design, and has, lately, appeared in a new form, and is said to be now in operation on the Regent's canal. There is an account in Belidor's *Architecture Hydraulique*, of a lock, constructed by M. Dubie in 1643, on the canal of Ypres, on this principle, where the lift was 20 feet. In this, two reservoirs were formed, one on each side of the lock with which they communicated, but on levels differing from each other: both of them, however, being between the levels of the canal. When the lock was full, and it was required to empty it for the descent of the boat, one-third of the water of the lock was let off into the upper reservoir; another third was then let off to the lower reservoir; the remaining third, having an elevation but little above the lower canal, was then let into it, and the boat passed out. Now, in these operations, supposing the reservoirs of such extent that the water let into them would not sensibly elevate their surfaces; two-thirds of the water which filled the lock, is still retained, at

more than two-thirds of its former elevation, and it may be again applied to fill the two inferior thirds of the lock: this was done in the canal above described, and the whole quantity of water required from the upper canal, to pass a boat, is said to have been but six feet. It is evident, that if the water be divided among a great many reservoirs, all on different elevations, the water of the locks may be saved to a yet greater extent.

Several locks with reservoirs, resembling the above, have been constructed in England. The form used on the Regent's canal, to which we have alluded, consists of two locks placed beside each other. One of these being filled, and the other empty, and two boats ready to pass in different courses, the water is permitted to run from the full lock into the empty one, which it fills half full; the remainder is then supplied from the summit, and the boat elevated to the upper canal, while the boat, and the remaining water in the other lock, is let off as in ordinary cases.

[TO BE CONTINUED.]

On Crude, or Unburned Bricks, and on Factitious Stone. Abstracted chiefly from M. Hassenfratz's *paper on that subject. By the Editor.*

It is a fact well known, that crude, or unburned bricks, were extensively used by the ancients, as they are found in the ruins of various towns and edifices, which were erected at a very remote period of time; among these may be particularly mentioned, the ruins of Babylon, from which, at a recent period, have been obtained both burned and unburned bricks, in a state of preservation so perfect, as to exhibit the inscriptions impressed upon them at the time of their formation.

In Europe, and in this country, the use of burned bricks of small dimensions, has been continued, but crude bricks are rarely employed; scarcely ever, indeed, excepting in the construction of ovens, furnaces, or fire places, where they will receive a degree of baking, which will render them durable. Crude bricks are still extensively used in some countries of Asia, and it may be worth while to inquire, why the practice is not more general, particularly in places where stones and fuel are scarce.

Two opinions upon this subject, altogether irreconcilable, have each their advocates. Crude bricks, it has been declared, have but little solidity, and soon moulder; it has been on the other hand averred, that they are so durable, as to be preferable to stone, for building. From the details given by Vitruvius, who flourished in the reigns of Julius and Augustus Cæsar, it appears that crude bricks of two kinds were anciently used; the one, made of a mixture of sand and argillaceous earth, very similar to that we now employ; the other a mixture resembling our mortar, being a composition of lime and sand, or of lime and other substances, forming a kind of

artificial stone. The first kind required and received a long desiccation, as they were frequently large in their dimensions, and if not thoroughly dried before having been used, they would afterwards have shrunk, to the injury or destruction of the building.

Argillaceous bricks, when used unburned, must contain a much smaller portion of sand, than those which are burned, as they would, otherwise, readily absorb moisture, and soon crumble; and this circumstance will account for the great length of time required to dry them. The purest natural clay would, probably, be the best, and this, if repeatedly pressed during the desiccation, would acquire a degree of solidity, which would enable it to withstand the vicissitudes, even of our variable climate. In hot and dry countries, as in Arabia, where it seldom rains, crude bricks of a less firm texture, may last for ages; with little or no apparent change in their appearance.

Ancient ordinances are still extant, which declare the dimensions that the bricks ought to have, as well as the proportionate thickness and elevation of the walls; and also the length of time during which crude bricks must be allowed to dry. At Utica, this was extended to five years, a less period not being accounted sufficient to ensure that perfect stability which should preserve the plaster work, or other incrustation with which they were to be covered, from a liability to be loosened and separated. The bricks in general use among the Romans, were a foot long, and half a foot broad. Two sorts were used by the Greeks, the one measuring about a foot, and the other about fifteen inches on every side; the first were used in private, and the latter in public, buildings.

In Babylon, and other places, a kind of bitumen was used as a cement for the bricks, and this, as it became extremely hard, and was impervious to moisture, had a powerful tendency to protect the crude, argillaceous bricks from the influence of atmospheric changes.

To the second kind of crude bricks, which are made with mortar, may be given almost every degree of hardness, from that of the most fragile, to that of a very hard and durable kind of stone, according to the goodness of the lime, and the qualities of the other materials entering into their composition.

The Romans regulated with great care the preparation which should be given to mortar, before it was employed; and M. Delafaye has pointed out many mortars proper for the formation of these bricks, or factitious stones; as, for example, one measure of lime, slacked dry, and three measures of pounded stone, sifted, to which add the necessary quantity of water, and work the whole well up together: or, secondly, one measure of fine dry sand, free from clay; one measure of sifted stone powder, and one of dry slacked lime, with just water enough to make it unite, and then well worked together:—thirdly, five parts of rough, sharp sand; two parts of fresh burned, dry slacked lime, with water enough to render it adhesive, but no more:—fourthly, one measure of dry, pulverized clay, kneaded with oil; eight measures of fine clean sand, or of pulverized and sifted stone, or of the two combined, and two measures of recent quick lime; moisten the eight measures of sand or stone, and work them

up like soft mortar; bruise the lime, fine, and add it thereto; with a trowel or pestle, knead it well up together, adding water if necessary, to render the whole adhesive, but no more of it than is requisite for this purpose; when perfectly mixed, and whilst yet warm from the slacking of the lime, add the clay which was kneaded with the oil, and beat them till thoroughly incorporated. This mortar must be quickly used, as it will speedily set, and become impervious to moisture.

In Piedmont, factitious stones are made, which they call *prisms*, from the form given to them, which is that of a triangular prism, as they are principally intended for the projecting angles of walls. They use an excellent aquadurant lime, which is slacked in the usual way, and left for four or five days, to complete the process; it is then placed in the centre of a hollowed heap of sand, unequal in grain; from the ordinary size to that of coarse gravel; the whole is then carefully mixed. A triangular trench, of indefinite length, is prepared in a situation free from the risk of inundation, the sides of which are carefully smoothed by the aid of a trowel and some water. The prism is then formed by successive beds of the mortar, and pebbles of uniform size, equally distributed: the prism is then covered with the earth, which had been dug out, to the thickness of nearly a foot. The proportions of the ingredients used, are about 14 parts of lime in a pastey state, 90 parts of the unequal grained sand, and 20 of the pebbles. These prisms commonly lie buried for three years; at the end of this time they will bear very heavy loads; and when let fall upon each other from a height of 20 feet, or upwards, may be chipped at the corners, but will not be broken.

From the ordinary kinds of lime, good small bricks of this description, may, undoubtedly, be made; but for factitious stones of large size, those limes must be used which solidify quickly, as the magnesian lime and puzzolano of Italy; Parker's cement, and the other hydraulic limes of England, and of this country, or the factitious hydraulic limes, like that described p. 355, vol. 3. of this journal; or p. 371, vol. 2. Moulds of various forms may be made, and the artificial stones consolidated by beating and pressure, whilst yet partially soft.

Delafaye is of opinion, that to the numerous other proofs of the ancients having made large artificial stones, for many of their edifices, the great Egyptian pyramids may be added. The stones which form the facings of these structures, he, unhesitatingly, declares to be of this kind. They have all the same dimensions, and are about 30 feet long, 4 broad, and 3 in height. They have no connecting cement, and fit so closely, that the blade of a knife cannot be inserted between them. A fragment, when sawed or broken, perfectly resembled factitious stone; being without any connecter, such as usually appears in the natural compounded stones. A fragment of a similar stone, which was taken from the ancient buildings in Alexandria, contained, imbedded in it, a piece of brick, which had, evidently, been burned in a furnace. There is no quarry, within a very great distance, from which the stones could have been obtained: and it is

also thought, that their weight, about 65,000 lbs. each, is so immense, as to render it highly improbable that they could have been transported, and afterwards raised to so great a height.

Several other reasons are urged to prove the correctness of the opinion, that these and other large masses of stone, are factitious. In more modern buildings, it is declared that artificial stone has been employed; the pillars of the church of St. Amand, in Flanders, and the columns of that of Vezelai, in Burgundy, are, it is said, acknowledged to be of this kind.

We shall not introduce the reasoning of those who deny, or controvert the opinion of the factitious character of these stones, as we have now nothing to do with this controversy, our only object being to show that such stones were, probably, made by the ancients; and that, certainly, we have the materials, and are acquainted with the process by which they may be formed. These materials are various, and require to be differently treated. Those which set slowly, may be consolidated and improved by beating and pressure; those which set quickly, like Parker's cement, and some others, must be allowed to do so undisturbed. Some kinds should be allowed to consolidate, shut up in a damp situation, or covered up in the ground. Experiment and observation, in fact, must determine the best mode of procedure, in each individual case.

ENGLISH PATENTS.

To John Guy, *and* Jacob Harrison, *Straw Hat Manufacturers, for their invention of an improved method of preparing Straw and Grass to be used in the manufacture of Hats and Bonnets.* Enrolled January, 1827.

The subject of this patent purports to be an improved method of drying and preparing straw and grass for making ladies' hats and bonnets.

The straw is to be gathered soon after the corn has come to the ear, and long before it is in a state of maturity, that is, in the latter part of the spring, or beginning of summer. The straws may be cut off near the ground, or drawn out of the ground with the roots. About one hundred and fifty straws are to be tied up in a bundle, and these bundles are to be laid upon a grass field, and spread out in the form of a fan, where they must be allowed to remain for two or three days and nights, occasionally turning them over: after this, they are to be tied up in larger bundles, and suspended under sheds, upon lines or on hooks, for the purpose of drying up the sap.

From these places of shelter, the bundles of straw are to be removed into the sunshine, whenever the weather is fine, and frequently turned over, but great care must be taken, that they are always protected from rain, or other moisture, as the colour would become injured by damp. If by these means, the straws are not brought to a

beautiful gold colour, it may be desirable to expose them to the sun, in glazed houses, until the gold-like appearance has been perfectly attained. The straw thus prepared, may now be laid by for use, or for the market, in warehouses or stacks, observing that it be carefully protected from damp. It may be necessary to say, that wheat-straw is preferred for the purposes of making hats and bonnets, but other straws will, sometimes, answer nearly as well.

When grass is the material intended to be made into bonnets, in imitation of Leghorn, the stems of grass are to be gathered when its seeds first make their appearance, and are to be prepared and dried in the manner above described.

[*Lond. Journ. of Arts and Scien.*

To Thomas John Knowlys, Esq. *and* William Duesbury, *Colour Manufacturer, for their having invented certain improvements in Tanning.* Enrolled February, 1827.

This improved mode of tanning, consists in suspending the hides in a close vessel, from the interior of which the air is to be exhausted by means of an air-pump, and when the vacuum within is sufficiently perfect, the tanning liquor is admitted, which immediately penetrates into the pores of the hide, occupying the place from whence the air has been extracted. By these means the operation of tanning will be greatly facilitated.

The hides to be tanned, are introduced into the vessel, and are suspended by hooks at the upper corners, with weights at bottom to keep the skin extended. As many of these hides as may be required to be tanned, are in this way placed within the vessel, and when the lid is tightly fixed on, the air is to be extracted from the interior by means of an air-pump.

When a sufficient exhaustion has been effected within the vessel, the cock of the air-pump is to be closed, and another opened, and the tanning liquor introduced; after which, the air-pump may be again worked to draw all the air from the pores of the skins; and to prevent ebullition, a quantity of oil is to be placed upon the surface of the tanning liquor.

The tanning liquor is to be first used in a weak state, and its strength increased daily, until the process is complete. A pump and tube, are to be employed for drawing off the spent tan liquor.

The subject of this patent is an example of the wide range through which a valuable hint may be sometimes usefully extended. In the second volume of our first series, page 36, will be found a communication from John Oldham, Esq. of the Bank of Ireland, on his improved method of sizing, dying, and wetting paper, for printing Bank Notes, and other purposes, which process was, by placing the bundle of papers, in a close vessel, and after exhausting the air from the vessel, and, consequently, from the pores of the paper, intro-

ducing the size dye or water, which instantly penetrated the paper, in a more perfect way than had been effected by any other means that had been before resorted to.

The same mode of operating, has been, subsequently, employed in dying, and in some other branches of the arts, with very great success, and is, in the patent above, proposed to be applied to tanning. But with what propriety it can now be claimed as a new invention, we do not see; the exclusive right of employing the same principles, as a novel process in tanning, appears to us to be rather equivocal.

[*Ib.*

To William Cleland, *Gentleman, for his Improvements in Evaporation.* Enrolled January, 1827.

The principal object of these improvements is, to cool liquids, such as brewers' worts, distillers' wash, dyers' liquors, &c.; the mode proposed is, to separate the particles, by causing them to descend in a shower, through which a current of air is to be passed.

The rationale of this process, depends upon the principle, that the steam from heated liquors, carries off a very considerable quantity of caloric; if, therefore, the particles of the liquor, can be so separated, as to increase the surface, and, consequently, the quantity of steam evolved, the cooling process will, by that means, be facilitated.

The patentee has not exhibited drawings, of any precise form of apparatus, but states, that over the boiler, or pan, containing the hot liquor, he places a vessel intended as a reservoir, into which the hot liquor is to be raised from the boiler, by means of a pump. The bottom of this reservoir, is partially perforated with holes, like a colander, extending across the bottom, and about twelve inches wide. Through the colander, the hot liquor descends in a shower, and the air having a free passage under the reservoir, through the shower, drives off the steam, and cools the liquor.

The steam may be conducted into a chimney, and thence escape into the air, or it may be passed through tubes, and brought under other pans, for the purpose of heating other liquors, by which means a saving of fuel will be effected.

In order to increase the effect, several colanders may be placed, one below the other, and the liquor be made to pass through them in successive showers. It is presumed, that the natural current of the air, will be sufficient for the accomplishment of the object; but if it should be found necessary, a blast of air may be produced, by means of a blowing machine.

Instead of employing cold air at all times, the patentee proposes, under some circumstances, to pass a current of dry heated air from a furnace, through the shower of liquor, which air having been rendered extremely dry, is then capable of absorbing the steam or moisture, which contained the heat, and this heated air may be mixed

with the smoke and other vapours, from the furnace, and be conducted in the manner above explained, under other evaporating pans, to heat them. [*Ib.*

To William Parsons, *Naval Architect, for his having invented certain Improvements in Building Ships or other Vessels, which improvements are calculated to lessen the dangerous effects of internal or external violence.* Enrolled January, 1827.

The patentee describes the modes of putting together the ribs of that description of vessels, employed for the East India service, and explains the present ineffectual mode of securing them merely by the flooring timber; to obviate which disadvantage, the present improved mode of strengthening vessels, is suggested.

The proposed improvement is, the introduction of cast iron framings, which are to be applied so as to connect the several ribs, and other timbers together, and which are to be placed in every part of the vessel, forming them, of course, according to the situations to which they are to be applied.

In thus adding to the weight of the ship, the patentee considers, that no disadvantages will arise, as the quantity of iron employed, will, in part, supersede the necessity of ballast, and, instead of weakening the vessel, as ballast would do, it will give it additional strength.

As the iron pieces must be formed, to suit the parts to which they are to be applied, no precise figure can be given, but they are to be made with grooves and rebates, to fit and take hold of the ribs, and with holes to receive the bolts or other holdfasts.

The patentee says he claims the connecting frames, for all purposes to which they may be applied, in ship-building. [*Ib.*

To John Charles Schwieso, *Musical Instrument Maker, for his Invention of Improvements on certain stringed Musical Instruments.* Enrolled February, 1827.

These improvements consist of three particulars. 1st. Connecting each of the tension forks, in the head of a harp, which act upon the *natural* strings, to springs placed over the top, for the purpose of steadying the forks, and keeping them from jarring, when the strings are touched. 2nd. Attaching springs to the back parts of the axles, or pins of the forks, which belong to the *sharp* strings, in order to press them to open, and operate against the pedal action. 3dly, Placing screws in a frame, in any situation between the ends of the strings, and the first bridge of a piano-forte, or other such instrument, which screws are intended to act upon the strings, for the

purpose of regulating the tension, that is tuning, with very minute accuracy.

The methods of adapting these contrivances, and their forms, may, of course, be varied according to circumstances; it is, therefore, unnecessary to exhibit figures, representing them, as the intention must be obvious, and the particular mode of carrying it into effect would, in a great measure, be subject to the judgment of the workmen.

By these means, the patentee considers the tones of such harps, piano-fortes, and other stringed musical instruments as the contrivances may be adapted to, will be greatly improved. Other advantages will also arise, which are not explained. [*Ib.*

To PETER MACKAY, *Gentleman, in consequence of a communication made to him by a foreigner, residing abroad, for an Invention of certain Improvements, by which the names of Streets, and other inscriptions, will be rendered more durable and conspicuous.* Enrolled June, 1827.

THE subject of this patent is, enamelling letters on glass, which, being put together, and made fast in a frame, are to be employed for out of doors inscriptions, such as the names of streets, in situations exposed to the weather.

The method of making the letters, as proposed by the patentee, is this:—Take pieces of common window glass, and having carefully cleaned their surfaces, paint upon them the required letters in enamel colour, using, if necessary, a drawing at the back of the glass, or a metal letter, as a pattern. If, by the spreading of the colour, the shape of the letter, when so painted, is inaccurate, that is, too thick in parts, the paint must be carefully scraped off from the glass, in those parts, and the glass wiped very clean.

The painted glass may then be burned, or baked in an oven as usual, to fix the enamel, and must be allowed to remain in the oven or kiln, until cold; when the back of the glass must be varnished, or otherwise covered with a dark coloured material, in order to render the white letter conspicuous.

The pieces of glass, with the letters so prepared, being now cut square, may be put together in a slight iron frame, and formed into words, the letters being secured therein, by means of cement or mastich.

Names, or other inscriptions, so formed, being fixed up at the corners of streets, will be found to be very much more conspicuous and durable, than those painted in the ordinary way.

The patentee observes, that he is aware letters have been enamelled on glass before, but claims, as his invention, the employment of such enamelled letters for the inscriptions at the corners of streets, and other exposed situations. [*Ib.*

To Joseph Cliseld Daniell, *Clothier, for his Invention of certain Improvements in Preparing Wire Cards, for Dressing Woollen and other Cloths.* Enrolled December, 1827.

This improvement in wire cards, is designed to render them more fit for the dressing of cloths, than wire cards of the ordinary kind, the patentee proposing to employ them in the gig machinery, as a substitute for teasles.

The wires for making these improved cards, are of two kinds; first, slender wires with sharp hooked points, standing out for the purpose of penetrating into the cloth as it passes, and drawing out the fine ends of wool which are to constitute the pile: second, a stiffer sort of wire, with blunt points, standing a little below the former, which are designed to protect the cloth, and prevent its surface being too much disturbed and injured under the operation of the machine.

The ordinary construction of wire cards, is so well understood, that the above description, it is presumed, will be perfectly intelligible: it is only necessary to add, that the same improved cards, are proposed to be employed for hand dressing, as well as adapted to the gig barrel, and in that case, it is adviseable to place three or four rows of the stiff protecting wires, in the front part of the card, to prevent the points penetrating too far into the cloth. [*Ib.*

To Joseph Frederick Ledsam, *Merchant, for an Improvement in Purifying Coal Gas, by means not hitherto used for that purpose.* Dated March 2, 1827.

Mr. Ledsam divides the improvements, comprised by his patent, into two classes, the first of which relates to the preparation of the coal gas for combustion, and the second, to depriving it of all fetid odours.

For the first purpose, muriate of ammonia (which is obtained by pouring muriatic acid into the ammoniacal gas liquor, and by the evaporation and crystallization of the mixture) is dissolved in water, in a large vessel, and to this solution, lime is added, in the proportion of 50 pounds to 100 pounds, of the muriate of ammonia; and through this liquor, stirred up occasionally, the coal gas is made to pass on its way to the gas-holder. When the prepared liquor ceases to act, it is drawn off, and fresh materials are put into the vessel, as at first: and to the liquor that has been drawn off, muriatic acid is added, and then muriate of ammonia is prepared from it, by the process above-mentioned. Sometimes the patentee uses sulphuric acid, instead of muriatic acid, in which case he uses magnesian lime in place of common lime, in order to obtain sulphate of magnesia (Epsom salts) from the liquor, as well as sulphate of ammonia; which

latter he then uses instead of muriate of ammonia, for the purpose first stated.

In order to deprive the coal gas of its fetid scent, which is the second object of the improvements, the patentee mentions that he uses "chloruret of sodium, or chloruret of calcium," (commonly called oxymuriate of soda, and oxymuriate of lime,) but by preference the latter, on account of its greater cheapness; of either of which he adds about 1 part to 30 of water, in a shallow vessel, and causes the gas to pass through it before it is conveyed to the burners; which he asserts, not only deprives it of all disagreeable odour, but makes the air of the room in which the gas is burned, pure and wholesome. A shallow vessel of 4 inches deep and 18 inches square, filled with the solution of the oxymuriate, is stated to be sufficient for the purification of gas enough for one burner.

The chloruret, or oxymuriate of lime, may also be used in the state of powder, for the purification of the gas, by making the gas pass over an extended surface of this salt; but the method first mentioned of using it in solution, is preferred by the patentee.

[*Repertory*.

A Report on a Process for Seasoning Timber; invented by John Stephen Langton, Esq.

Mr. Langton having discovered a new method of seasoning timber, consisting in the removal of the greater part of the atmospheric pressure, and the application of artificial heat, by which the time necessary to season green timber, and render it fit for use, is only about twice as many weeks as the ordinary process requires years: he requests my opinion, first, on the influence this mode of seasoning may be expected to have on the wood; and secondly, on the practicability and advantages of the process on the large scale.

The ordinary mode of seasoning timber, consists in evaporating the fluid matter, (called sap,) by the natural warmth of the atmosphere, with the precaution of screening the timber, both from the direct action of the sun and wind, otherwise it cracks and receives much injury.

But seasoning, by the natural warmth of the atmosphere, proceeds slowly and irregularly, and much loss by decay takes place, unless the operation be conducted under the protection of a roof, to exclude rain and snow. Seasoning under cover, is still a slow, though an expensive process, for at least three years should elapse, from the time of felling the tree, to that of its being used in such framing as is wanted in naval architecture; hence, a stock of timber, equivalent to four years consumption, must be kept on hand, and three years consumption must be either under cover, or suffering still greater loss, by exposure to the wet.

In the new process, the power of an air-pump is added, to draw the sap out of the interior of the wood, and the tendency of the fluid

to the outside being thus increased, a higher temperature than that of the atmosphere can be applied, with less risk of causing the timber to split; consequently, the process may be completed in less time, and a few trials will show the best relation between the time and heat for the different kinds of wood.

Having briefly stated the process, I can, with more clearness, show the strong grounds on which my opinion is formed.

First, then, as to the effect on the durability and strength of the wood. In the new process, as in the ordinary one, the sap is removed by evaporation; no solvent of the woody fibre is, therefore, introduced in either case, while the sap itself, being a fluid readily affected by temperature and other agents, it seems obvious, that the sooner it is wholly removed from the wood, the better, provided the woody fibre contracts and solidifies without injury. That this may be done, is evident, from the specimens from which the sap has been extracted; they exceed the usual density of specimens equally dry, and have lost about the same weight in drying, that is lost in the usual method, with a somewhat greater degree of shrinkage. The sap which is extracted, is a nearly clear liquid, having a sweetish taste, with a very peculiar flavour, and a musty and disagreeable smell. The latter seems to proceed from a light, flocculent kind of matter, floating in the sap, affording the strongest evidence, that the sooner such matter is removed from timber, the better; and as it appears that the whole of this matter is removed by completing the process, I am of opinion the new mode of seasoning will render timber more durable than the common one, and it does not appear to be in any degree deteriorated in strength.

Secondly, the method is, undoubtedly, practicable on the large scale, and at an expense not exceeding ten shillings per load, with the advantage of setting free, at least half the capital required by the common method; the advantage of rendering the living tree available, either for defence, convenience, or common use, in a few weeks after being felled, and in a state in which it may be trusted with safety; while, by the usual method, five years is not more than is necessary to be equally free of risk from shrinkage and decay. The usual practice is, to use timber partially seasoned, in consequence of which, the sap has to evaporate, and the wood shrinks, the joints open, and the carpenter's skill in framing, is rendered nugatory; for, as timbers shrink, frames change their form, and lose their strength, and ships and houses alike afford evidence of the fact, particularly ships sent out to warm climates.

It only remains to add, that, by the new method, the whole of the natural sap is extracted at once, from the tree; it is known, by very simple means, when the whole has been extracted; the process requires only eight or ten weeks; it is more economical, and locks up less capital than the common method; and it contributes to the durability and soundness of timber framing. THOMAS TREDGOLD.

[*Lond. Journ.*

On the Silk Worm.

To the Editors of the London Journal of Arts, &c.

Gentlemen,—Having some years ago been led in the course of business, to reside for some time in the south of France, and being intimately connected with silk reeling, my attention was attracted to several particulars in that branch of French national industry; among others, the following has always appeared to me to be well worthy the attention of men of science. Every one who, whether in England or abroad, has ever bestowed the slightest attention on the silk worm, either as a matter of curiosity, or as a matter of business, must be well aware, that some of the cacoons are white and some yellow, but every one is not, perhaps, aware that yellow gum silk, reeled from the yellow cacoons, is strongly impregnated with an odour, resembling that of violets, at the same time that white gum silk reeled from white cacoons, is perfectly free from odour of any description; I therefore beg leave to propose, for solution, the following question. "What is the reason of yellow gum silk being impregnated with an odour of violets, whereas white gum silk is free from that or any other odour?" Having proposed the question, I add the following particulars for the information of those who may be disposed to attempt the solution of it. 1st, the fact above stated, is invariably found to exist, in the south of France, even though the worms, forming the different coloured cacoons, may have sprung from the same parent stock, and even though they have been fed from the same tree; 2nd, the yellow gum silk is always specifically lighter than the white; and, 3d, so strong is the odour of violets with which the yellow gum silk is impregnated, that a few pounds of yellow being confined for two or three days with several cwts. of white, shall suffice to impart a strong odour of violets to the whole mass; let both be exposed to the air, the white soon looses its acquired perfume, but the yellow retains it, and will continue to do so for ten or twelve months. In what I have stated above, I should wish to be understood, as confining myself strictly to French silk, and that in the raw state, before it has been submitted to the operation of throwing; whether the same peculiarity exists in the Greek, Chinese, and Indian silks, I have had no opportunities of judging, nor can I, not being perfectly acquainted with their system of reeling, form an opinion, whether in that operation, there may not be some extraneous matter employed, which might, even if the peculiarity above named did really exist, prevent its being noticed.

Should you deem the above question worthy a place in your Journal, I shall feel obliged by your insertion of it.

I remain, gentlemen, your obedient servant,

W. B. Honyman.

London, May 7th, 1828.

Generating and Purifying Gas for Illumination, upon a new Plan.

We formerly noticed Mr. Pinkus's improvements relative to the production of gas, by means of a simple apparatus, which is to be adapted to the fire-place of a counting-house, or a kitchen-range, in order to supply illuminating gas, for the use of the house and premises, immediately contiguous. This apparatus appears now to have been proved, and found fully to answer the expectations of the patentee; we shall, therefore, take an early opportunity of laying the plans before our readers, indeed, we only now withhold them at the request of the patentee, the foreign patents, which are in progress, not having been yet completed. The following is a paper presented to us by the inventer.

The superiority, brilliancy, and convenience of gas lights, having led to their introduction and use in most parts of the united kingdom, the attention of men of science, and capitalists, has been continually devoted to the formation and perfection of establishments necessary for ensuring extensive supplies of gas to the public, and adopting improvements to effect its purity. To attain the latter of these objects, various patents have been obtained, and numerous experiments tried: but, hitherto, the purest gas distributed, has been, when not in a state of ignition, extremely offensive; and when burnt in close rooms, frequently injurious to the health. It is also deserving of particular notice, that, notwithstanding the many improvements which have been effected, the numerous establishments which have been founded, and the remarkable extension of the use of gas, the public attention is now directed to the object of obtaining reductions in the price of that indispensable fluid.

The object of the patentee is, to form a Domestic Gas Company, to furnish, or, rather, to enable every householder, and occupier of premises, to supply himself with a cheaper, purer, less noxious, and more brilliant gas, than any which has yet been produced; not in the spirit of opposition to the opulent and respectable companies which have so long been established, but with that aim, at fair and honourable competition, which must tend to the advantage of the public.

To prove the convenience and safety of the process, it is only necessary to state, that no additional fire-place or stove, will be necessary for generating the gas required, the operation being performed by the combination of a particular apparatus, with an ordinary kitchen-range, or other common fire-grate, so connected, as not in the slightest degree to interfere with its usual purposes, the superfluous heat being used to effect the object; the gas then passes through a refrigerator, and the patent purifier, into the gasometer, which may be placed in the cellar, or other convenient situation. The only attention which this process will require, will be for a short time (not half an hour,) in the morning, before the fire is lighted, it being so safe and regular, as not to need the slightest notice during the day or night; and as the residuum constantly returns to the retort, and is consumed, no nauseous remains are left to be disposed of.

The purification of the gas, is effected by a new method, the noxious odour destroyed, and the gas rendered inoffensive, pure, and brilliant.

Patents have been obtained for the mode and apparatus for generating, and for purifying gas, and very heavy expenses incurred in bringing the invention to complete perfection.

The patentee proposes to fix the apparatus on the premises where it may be required, at his own expense, and receive an extra remuneration for the first year only, according to the number of lights wanted; after which, he engages that the whole expense per annum, including patent right, shall not exceed one-half the present cost of gas supplied by the leading companies; but individuals may, in all cases, have the option of purchasing their right for a fixed sum, rated to the advantage of the purchasers.

It is conceived, that in towns and other places where gas establishments have not yet been formed, inns, manufactories, public works, and premises of various descriptions, the proposed Patent Domestic Gas Company will be able to render an important service, and confer an extensive advantage; and the proprietors beg to assure the public, that no exertion shall be spared, to render the invention worthy of the encouragement and support of this great commercial country. [*Lond. Jour.*

On the Condensation of Coal Gas.

To the Editors of the London Journal of Arts.

Gentlemen,—Manufacturers of coal gas, are not, perhaps, generally aware how much the process of *condensation*, contributes towards the *purity* of the gas.

Coal gas should not be subjected to the *purifier*, (that is, to a vessel containing certain ingredients having an affinity for sulphur,) until it has been first thoroughly cooled, or *condensed*, as it is termed, and divested of its tar and other oleaginous particles; and also of its hydro-sulphuret of ammonia. It contains these in great abundance, when first evolved, and, unless it be well condensed, will never get sufficiently rid of them. After being completely divested of these offensive ingredients, by condensation, the gas may then be slowly passed through the purifying vessel, to extract the *sulphuretted hydrogen*, and what remains of carbonic acid gas, &c.

The process of *condensation*, however important to the wholesomeness, purity, and even the brilliancy of gas, is still very indifferently understood, and imperfectly executed. In London, the mode of condensation generally adopted, is, merely to pass the gas through tubes, or between plates, which are merely cooled *externally*, by means of air or water. It must be admitted, that, if this method be pursued to a *certain extent*, and at a certain rate of expense for machinery, of course, according to that extent, the tar

and other oleaginous particles, as well as a great proportion of the hydro-sulphuret of ammonia, *will* be extracted; but it is a fact, which cannot be disputed, that, however expensive the vessels for condensation, (in most of the London gas works even) the condensing process has never yet been carried in any one of them, so far as to divest the cooled gas sufficiently, of its ammonia, either before or after passing through the purifier; and we well know that it is this very *ammonia*, which, when the streets are opened, or a leakage occurs, produces that putrescent effluvia, rendering *imperfectly condensed gas* so extremely offensive, and pernicious.

In the beginning of 1823, Mr. Tait, Civil Engineer, then in charge of the Bow Oil Gas Works, communicated to one of the directors of the city of London Gas Works, a plan, which he had conceived, of bringing the crude gas, *in immediate contact with the cold water, in the condenser:* thus proposing to combine the effect of the *temperature*, with the *chemical affinity*, which it is well known water has for ammonia. The idea was fully appreciated by the scientific gentleman to whom it was imparted, but not at that time put in execution. In 1825, however, Mr. Tait, having been sent down to Ayr, in Scotland, to erect gas works there, for the British Gas Company, constructed a *condenser*, on the above-mentioned principles. The gas made at Ayr, has been tried by several individuals, (perfectly competent to judge of the purity and quality of carburetted hydrogen gas,) and they have invariably declared *it to be the purest and best gas they have ever examined.* The superiority of the gas here, is chiefly ascribed to the effect of the very excellent condensation. At Dalkeith, Mr. Tait has since constructed a similar condenser; but the works there, having fallen into an imperfect management, and ignorant hands, cannot, of course, be referred to, as proving in one way or another.

I am, gentlemen, yours, &c.

Edinburgh, 16*th June.* X.

We have been promised a drawing and more minute description of Mr. Tait's improved condenser, (as erected at Dalkeith,) which we shall have much pleasure in submitting to our readers when it arrives. [*Editor Lond. Journ.*

Observations on the Luminous Appearance of the Sea.

Mr. Finlayson, in his "Mission to Siam and Hue," has the following paragraph relative to the luminous appearance of the sea near Prince of Wales' Island:—

"Nothing is more singular in these seas than their phosphorescent appearance by night; the ocean showing, like a vast lake of liquid fire, melted sulphur, or phosphorus. In many bays, such as the harbour at Prince of Wales' Island, the bodies which emit this singular light, exist in such vast quantity, that a boat may readily be distinguished at the distance of several miles, by the brilliant light, re-

sembling that of a torch, proceeding from the water, agitated by her bow and oars. We have seen the sea rendered of a green colour and slimy appearance, by day, so that it might have been mistaken for the green vegetable matter common on stagnant pools. We have taken up a quantity of this green-coloured water, and, by keeping it till night, have ascertained, that the green colour by day, and the phosphorescent appearance by night, were occasioned by the same substance.

"The causes of this luminous appearance in the sea, are, doubtless, various in different parts of the ocean. We know that fish, when dead, afford a similar light; and experiments have shown, that dead fish immersed in sea-water, after a time, afford it also. The spawn of fishes is said to afford it, and putrefaction is considered as a very common cause of this appearance. In the present instance, it appeared unequivocally to proceed from innumerable granular gelatinous bodies, about the size of a pin's head. These, when taken upon the hand, moved about with great agility for a second or two, when they ceased to be luminous, and remained immoveable."*

[*Lond. Journ.*

On Tinning Cast-Iron Weights. *By* M. Bigou.

From the 'Industriel,' and Gill's Technical Repository.

These are first to be well rubbed and cleansed in a bath of sulphuric acid, (*oil of vitriol*) which has been diluted with a proper quantity of water. After this preparation, they are to be dipped into water, in which sal-ammoniac has been dissolved, in the proportion of one-seventeenth of the salt, to the quantity of water employed. During these operations, we melt fine and pure tin, with which has been previously mixed copper, in the proportion of three ounces of this latter metal to one hundred pounds of the tin. When the mixture has been melted at a proper degree of heat, not so high, however, as to hinder it from attaching itself to the pieces of cast-iron to be tinned, they may be plunged into it.

The weights should be previously turned into shape, in the lathe, and be made smooth before tinning them; and when they have become cold, after the tinning process, they may be polished in the lathe by means of burnishers in the usual manner.

In order to render the three ounces of copper easily fusible in the tin, it should be previously melted with six pounds of that metal, taken from the one hundred pounds.

This tinning of the weights is designed, not only to preserve their size and weight better, but also to prevent them from rusting; and we can thus substitute these cheap cast-iron weights, in the room of the more expensive ones of brass or copper.

* This was to have accompanied Lieut. Ingall's article on the same subject, in the last number.

On rendering Platina Malleable; as practised at St. Petersburgh. By M. J. Eichfeld.

From the "Journal d'Odessa," for August, 1827.

In France, before the year 1810, in order to render platina malleable, it was melted with white arsenic, (the deutoxide of arsenic,) the ingots were then heated in a violent fire, in order to volatilize the arsenic in part; they were next impregnated with oil, and again heated, in order to volatilize the remainder of the arsenic. After this, they purified the platina, by dissolving it in the nitric acid, and then boiled it in distilled water, before subjecting it to the action of the hammer; but they abandoned this process, as it required too much time in the different heatings. Since 1825, indeed, M. Breant has worked platina, but by means which are unknown. We now obtain a considerable quantity of this metal from the Uralian Mountains, in Siberia; and the *Corps des Mines*, at St. Petersburgh, have made many different trials to render it malleable. Last summer they conducted the process in the following manner:—they took the crude platina in grains, and separated the iron it contained, by means of the magnet; they then dissolved the remainder in *aqua-regia;* and after the solution had become cold, filtered it, and added to the liquid a solution of the hydrochlorate of ammonia, which produced a yellow precipitate, formed by the hydrochloric acid, the platina, and the ammonia. This precipitate they washed repeatedly; and when dry, it was calcined in an earthen vessel. It then acquired a spongy consistence, and was the purified platina. They afterwards boiled this spongy mass in a little hydrochloric (muriatic) acid, washed it in hot water, and dried it. The mass thus prepared, was placed cold, in an iron mould of a convenient size; and either round, or of any other form; but the round or cylindrical mould, is the most manageable. They next compressed the platina in the mould, by the aid of a powerful screw-press, which produced a compact plate having a metallic lustre. This plate is not, however, malleable; to give it this property, it is heated to whiteness, and in this state is again submitted to the action of the press, when the mass becomes united, and gains a perfect ductility.

Since this invention, the directory of the mines has permitted this malleable, as well as the crude platina, to be sold. Those persons who desire to possess it, may apply to the *Corps des Mines*, at the Mint of St. Petersburgh; the following are the prices fixed:—the metal in its crude state, is three roubles ($2 13) the zolotnic (66 gr. Troy;) in the purified and spongy mass, at four roubles; and in ingots, bars, wire, &c. at five roubles. The ingots and bars may be had of any required sizes. This malleable platina serves for making chemical vessels, various instruments, and other vessels; also for teapots, knives, cooking utensils, watch-chains, &c.

Note.—This process is not new; it is known and practised in France; and has also been known and used in this country for upwards of twenty years, although nearly kept secret, and in but few hands. [*Editor Tech. Rep.*

On an improved Surgical Instrument Maker's and Cutler's Mill. By THOMAS GILL, ESQ.

THE Editor saw, a few days since, in the city, a surgeon's instrument maker, polishing lancet blades on a tool driven in a mill worked by himself, with a considerable velocity; and thus completely avoiding the expense of having a turn-wheel to pay, as usual.

The mill was contained within and supported upon a wooden frame, about four feet high, three feet wide, and six feet long; firmly braced to the floor, and strengthened by iron bands; but it would have been much better had it been mounted upon a firm cast-iron frame. Near the front end of the mill, a cast-iron band-wheel, similar to that of a foot-lathe, of three feet in diameter, and with a heavy periphery or rim to it, and light arms, was mounted upon an axis, with a cylindrical neck or pivot at each end of it, and having a double crank formed upon it, the necks of which were placed in opposite directions to each other, and a hook was hung upon each neck, descending to two wooden treadles, turning at their back ends, upon a cylindrical rod passed across the frame, and having staples driven into the upper sides of them, into which, other hooks, formed at the lower ends of the crank hooks, were passed; these treadles at their outer ends, came within convenient reach of the feet of the workman, who was seated upon a bench laid across two sloping supports, projecting from the two front ends of the frame, and who could thus communicate *two impulses to the wheel at each revolution of it;* and also govern its motion so as to cause it to move quicker or slower at pleasure. In order still further to increase the velocity of his grinding, glazing, and polishing tools, a leather band was passed from the band-wheel around a small rigger or band-wheel, about five inches in diameter, from which another leather strap or band was passed around the pulley which was affixed upon the right-hand end of the spindle of each grindstone, glazer, or polisher, and which pullies varied in their diameters, according to the greater or lesser velocity with which the different tools required to be driven. The larger band-wheel was so placed, as just to escape rubbing against the workman's knee, and the spindles carrying the different tools, were mounted at the front end of the frame; and, indeed, the whole disposition of the parts, was most judiciously contrived, so as to save room in the workshop, and to perform their work in the most complete manner. The spindles upon which the grindstones, glazers, and polishers were hung, had, as usual, sharp conical points at their ends, and ran in holes made in wooden adjusting blocks in the same manner as they are commonly employed: and the necks or pivots of the two other axes ran upon hard steel hollowed plates.

Besides rendering the workman at all times perfectly independent of the caprice or irregular attendance of his turn-wheel, the absence of whom frequently causes delay and much loss of time; the room saved in the workshop, from the removal of the large band-wheel and its cumbrous frame, is a great advantage indeed. The workman

stated, that the power required to drive his mill for grinding, glazing, and polishing small works in cutlery, such as lancets, and other delicate surgeons' instruments, instruments for operating upon the eye, penknives, &c. was very trifling; but that in grinding razors, or still larger instruments, it was considerable; in this case, however, he was able to avail himself of the occasional help of an assistant, who, seated upon the bench behind him, could operate with his feet upon the outer end of the treadles, and thus render the labour comparatively light.

A water trough was supported upon hooks resting upon the top rails of the frame, with a splash-board in it, secured by a wedge, as usual in grinding articles of cutlery.

We hope that mills similar to the above, may now become more common than has hitherto been the case; and think that they may be applicable to a great variety of other purposes, than merely the grinding, glazing, and polishing of cutlery. Our description is, we believe, sufficient to enable any workman of competent skill, to construct them; but we may, possibly, hereafter give a figure of one of them, which will remove every difficulty therein. [*Tech. Rep.*

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS GRANTED IN AUGUST, 1828.

With Remarks and Exemplifications by the Editor.

1. For an *Hydrant Fountain;* Lewis Goulay, Philadelphia, Penn. August 1st.

The object of this invention is, to cool, and preserve in that state, the river water supplied by the public water works in large cities.

A cast-iron vessel is made to contain the water and the ice: this vessel consists of two concentric cylinders, having one common bottom. The outer cylinder is proposed to be 12 inches in diameter, and the inner, 6 inches; the former is to contain water, admitted from the water works through a pipe at the bottom; the latter is to contain ice, wrapped in flannel. A lid is made to fit firmly within the outer cylinder; this is to be fixed by soldering, to render it air tight, and to enable it to resist the pressure of the water. A separate lid covers the ice chamber; a cock is inserted for the purpose of drawing the cooled water from the outer cylinder, or reservoir, which is simultaneously supplied from the water works. A hole is left in the bottom of the ice chamber, for the escape of the drippings. Provision is made for cleaning the reservoir, occasionally, by the rushing in, and discharge of the water. The patentee claims,

"1. The principle of applying ice to water for the purpose of cooling the latter, without bringing either of them in contact."

"2. The modifying of the temperature of the water at will, by the adaptation of *iron*, for the reservoir, or fountain, (a well known sweetener and purifier of that fluid) and the exclusion of the atmospheric air, so that the natural water coming from beneath, may be

introduced in any quantity, to decrease the degree of cold, or excluded, to increase it."

"3. That in the machine, but 3 cents worth of ice per day, will keep three or four gallons of water constantly in a state of coolness, fit for use; for as much as is drawn out, is instantly replaced, to be acted on by the ice."

"4. That the reservoir, or 'Fountain,' as it is called, of the machine, is, in Philadelphia, and other cities, through the hydrant pipe, applied by my principle, constantly kept full."

"5. That the ice has no connexion with the water whatever, and communicates to it none of its dirt; it is preserved, by the air being excluded from it, when in the jar."

We apprehend, that the *principle* of cooling water by surrounding it with ice, is the same as that of cooling wine by the same means, and that the *practice*, in both cases, has been a very common one.

Would it not be an improvement to surround the vessel by a substance which would neither conduct, or absorb heat, so readily as the cast iron?

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2. For a *Signal Lamp;* Joseph Feinour, and Joseph Feinour, Junr. Philadelphia, Penn. August 1st.

The patentees state, that the ordinary signal lamp used at sea, is a foot in diameter, and 18 inches high; is covered with transparent horn, which is liable to injury, as it cracks readily, or may be burned by the flame of the candles usually employed in them. Their new signal lamps are only 4 inches in diameter, and 9 inches high; they are made either square, or with six or eight sides. A lamp, with two wicks, is firmly fixed to the bottom; in this, $1\frac{1}{2}$ gills of oil will give a brilliant light for 12 hours. The lamp is glazed on each side with a double convex lens, of from $1\frac{1}{4}$ to $1\frac{1}{2}$ inches thick, with many squares on their surfaces, which serve to magnify, refract, and disperse the light. The patentees state that "by these means this lamp will throw a light at the mast head, which may be seen *seven miles off:* a man may be distinguished by it 30 yards off; and at the distance of from 15 to 20 feet, a person may read by it.

"The inventors claim in this as original, the adaptation of a double convex lens with squared surfaces, to the lamp case, and the general construction of the case," as described.

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3. An improved *Washing machine;* Simon Willard, junr., Cincinnati, Ohio, August 2.

The description of this machine is of considerable length, and is complex. The drawing accompanying it, does not render the construction very clear; should we hear of its *washing its way into favour* with the laundresses, it may again claim our attention, otherwise we shall allow it to rest with its brethren.

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4. An improvement in the mode of *Raising and lowering*

canal boats, on inclined planes; William Knight, Morristown, New Jersey, August 5.

The importance of the subject of inclined planes is such, as to demand our particular attention to every thing which presents itself in the form of an improvement. If, upon a more careful examination of Mr. Knight's specification, we think that his plan can be understood without drawings, we will make an abstract of it in our next number; otherwise it shall hereafter be illustrated by engravings.

The main feature of his plan is, to raise and lower the boats, floating in a car, supported upon numerous wheels. The car to have water-tight gates at each end, one pair of which is to be opened to allow the boat to float in, or out, at the lower level; the other pair to be opened to allow the boat to pass in or out, at the upper level; there being leather valves, &c. used to make the car fit water-tight against the entrance, or mouth of the canal, at the upper level, previously to opening the respective gates which close the end of the car, and the entrance of the canal.

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5. For a *Thrashing machine;* Matthew Barney, Nantucket, Mass. August 5.

This machine is, in form, somewhat like the common horse gin. There is an upright shaft, with a bar projecting out, to which the horse that turns it is attached. Three arms, eighteen feet long, and fourteen inches wide, are passed through mortices, so as to form six radii from the centre of the shaft: these are connected together by six pieces of plank, each passing from the lower edge of one arm, to the upper edge of the next arm, and, consequently, forming six inclined planes. Eight flails, or thrashers, eleven feet long, work side by side, upon one common pin; their short ends, three feet in length, pass under the wheel, and are tripped by it as it passes round; the whole making 48 strokes in each revolution.

The grain is placed upon a table standing under the outer ends of the thrashers; this table traverses backwards and forwards, by means of a windlass. The patentee says, "by placing flax or hemp on said table, I believe it will break it equal, if not better, than any other way."

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6. For an improved mode of *Constructing breakfast and dining tables;* Peter Barker, Worthington, Franklin County, Ohio, August 6.

The dining table is to be circular; in other respects it may be like the ordinary dining table. A second circular table, or platform, precisely like the top of an old fashioned round tea table, is to be placed on and over the centre of the dining table, it being kept in its place by a pivot, or axle, upon which it turns. This centre, or upper table, is to be sufficiently small to leave room for plates, knives and forks, upon the lower table, whilst the various dishes are placed upon the upper one. The object is, to enable each person, by turning the upper table, to bring before him the dish which he desires.

7. For a *Curvilinear saw mill*; David Barker, Ipswich, Mass. August 6.

In this machine, the saw is made to move about the work, by means of an ingeniously contrived apparatus, denominated the gauge plate, which will guide the saw into any curve ordinarily wanted for ship building, and for many other purposes. We have a drawing of this apparatus in preparation.

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8. For an improvement in the *Machine for reaping and thrashing grain;* Samuel Lane, Hallowell, Maine, August 8.

This patent is for improvements upon machinery formerly patented. The combination of reaping and thrashing, appears rather incongruous; but the inventor has contrived, with great ingenuity, to apply a large portion of the machine for reaping, to the purpose of thrashing, so as to include the whole in one patent. He has, also, a roller, and other appendages, moved by the same power, for the purpose of shelling corn. No clear idea of the machine can be given, without numerous and complex drawings, to which the specification refers throughout.

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9. For an improvement in the construction and application of the *Quadruple forcing pump;* Ira Ferris, Ellicott, Chatauque County, New York, August 12.

This purports to be an improvement upon a double forcing pump invented, and formerly patented, by Ira and Thomas Ferris. It claims to be applicable to the raising, and discharging water for hydraulic purposes, to be applied to propelling mills, &c. in still water, such as lakes and ponds.

There is one ascending main; this is surrounded by four *forcing* pumps, which are filled through lower valves in the ordinary way, each of these has a communication with the ascending main, with valves to prevent the return of the water. The four pumps are worked by cranks upon a common shaft. Above the ascending main, is a large reservoir, or floom, to receive the water which is forced up. Below this reservoir is a water-wheel, which is to be kept in motion, by opening a gate at the bottom of the reservoir; in order to fill this, in the first instance, the pumps are to be worked by horse, or other power; *but when once filled, it is to supply water enough to turn the water-wheel with sufficient power to replenish itself, and to drive mills, &c.*

Neither our scientific readers, or practical mechanics, will ask us to extend our remarks upon this power-gaining apparatus; or wish for the minor details, of the gearing, connecting rods, &c.

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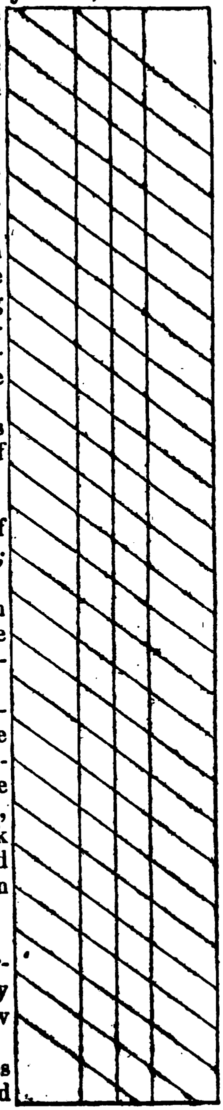
10. For *Propelling vessels* in the water; Hull Case, Huron County, Ohio, August 13.

This patent is taken for a scheme which has been repeatedly tried, and as repeatedly failed. The present patentee, however, assured

us, in conversation, that he had fairly tried the experiment, and that he is confident he can ascend against a current, and head wind, *by the force of the wind itself.*

He places a horizontal shaft across the vessel, which carries paddle wheels, like those used in steam boats. An upright shaft is eared into this horizontal one, by bevelled wheels: this upright shaft has projecting arms, which support four jib-sails, which are fixed in a manner very similar to those of some of our horizontal wind-mills, and which will turn, by the wind, be it in what direction it may. The force of the wind upon these sails, is to be the propelling power.



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11. For a method of obtaining *Ruled stereotypical writing paper.* Cayetano Lanuza. New York, August 13.

This patent is for printing ruled lines upon writing paper, with faint, blue, printing ink. The specification says, "the method of ruling writing paper, by means of wooden moulds, or stereotypical plates, and a printing press, is the improvement which I claim as made by me in the art of ruling writing paper."

The margin shows one, among the samples lodged in the patent office, with the exception of being printed with common typographical ink.

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12. For an improvement in the mode of *Fitting the hammer heads of piano fortes;* John Mackay, Boston, Mass. August 14.

The patentee says, "my invention consists in letting into the top of the hammer heads, a piece of lead, pewter, solder, zinc, tin, iron, composition of metals, or compound of metals."

"The advantages resulting from said invention and improvement, are as follows, to wit; the hammer head having any of these kinds or composition of metals inserted in the tops of the hammer heads, and then covered with leather, or any other covering, produces, when struck against the strings, a much stronger, fuller and firmer tone than that produced by the common mode of hammers."

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13. For an improved *Washing and pressing machine* for cleansing clothes; Henry Averill, Richland, Oswego County, New York, August 14.

In many particulars, this machine resembles several which have been already patented, and

the patentee does not distinctly inform us what he claims as new. A drum or cylinder is made to contain the clothes to be washed; this has circular ends of solid plank, but the sides are formed of about forty rounds, placed at about ½ an inch apart. Four additional rounds are placed within these, two on each side, diametrically opposite to each other. These are to carry the clothes to the vertex, from whence they fall, as the drum revolves. The drum is contained, and is turned by cranks, within a trough, the bottom of which is semicircular. Three or four wooden balls, about three inches in diameter, are put into the drum with the clothes, to assist in cleansing them. Over the trough of the washing machine, is placed a smaller trough, in which the clothes are to be pressed, instead of wringing them. The bottom and sides of this trough are perforated with many holes. The clothes being put into this box, a *follower* is forced down upon them by means of a lever and windlass, and the superfluous water runs through the holes into the lower trough.

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14. For a *Roller printing press,* for printing from types; Joshua Laird, Pittsburgh, Penn. August 16.

The *form* is to be placed upon a platform, and passed between two rollers, in the manner of copper plate printing; or several forms are to be ranged on the same platform, and a suitable roller is made to pass over them, and to press with sufficient force to print the sheets. The patentee is aware that rollers have, heretofore, been essayed for the same purpose, and, therefore, claims only his arrangement, or manner of fixing the roller.

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15. For an hydraulic apparatus for *Propelling boats* or other vessels. Benjamin Phillips, Southwark, Philadelphia, August 16.

Numerous contrivances have been made, to cause the valves, or buckets, by which vessels are propelled, to stand vertically, and, sometimes, to move horizontally through the water, under an impression that the oblique direction in which they dip and emerge, produces a great loss of power. Without touching the main question, we may aver, that whilst some of the plans proposed have manifested much ingenuity and science, no one of them has, hitherto, proved in practice, equal to the ordinary wheel.

The plan of the present patentee is, to hang hinged buckets along the sides, or in a well, or between twin boats; a reciprocating motion being given to the slide to which they are attached; when moving towards the stern, they are to open out perpendicularly, when towards the bows, they are to collapse. The following is extracted from the specification. "These valve buckets shut and open as they meet resistance from the column of water, forming right angles with the resistance, or centre, or parallel lines, when drawn forwards, with the middle of the vessel," offering no resistance, or partially so. These valves or buckets are moved on the longitudinal shaft, in like manner as the frame of an umbrella, or parasol, is opened, or hoisted upon the stick; or, in other words, act on the same principle as the

valves in a pump box, and may be constructed in a well, or cylinder, of wood, or metal," &c.

In the drawing accompanying the specification, the structure of the several valves, or buckets, is shown; they, in general, bear a strong resemblance to the *duck foot* valve, which is known to those conversant with the subject; the manner of working the valves is well expressed by comparing it with the 'opening and closing of an umbrella,' as there are tubes sliding upon a bar, with an arm, or stretcher, from them to the valve or bucket, with stops upon the bar, to regulate the angle to which they shall open and close.

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16. For an improved *Check and plaid power loom;* Enoch Burt, Oliver D. Boyd, and Amos H. Boyd, Manchester, Hartford County, Conn. August 19.

This cannot be described without an engraving, which will be procured. The patentees claim, "the shifting of shuttles to form any figure, without interrupting the motion of the power loom; and the stopping of a power loom by the breaking of a bobbin thread, or by the bobbin running out, from the bobbin thread being made necessary to prevent the loom from stopping, through its action on a slider, or lever."

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17. Improvement in the horizontal wind mill; Walter Ingalls, Strafford County, New Hampshire, August 19.

From the specification, it appears evident that instead of an actual wind mill, the model made for the office, was the subject of description, the numbers, therefore, must be taken as expressing proportion only. The mill is to be similar in its general structure, to some already known. There are to be four sails, the frames of which are to be "*eight inches in height and four inches in width,* that have canvass nailed unto them; they stand upright, and turn upon gudgeons between the top and bottom arm." These frames have check cords, to prevent their turning outwardly, and there are spiral springs, two to each frame, to prevent the cords from breaking by any sudden jirk. A cog wheel on the vertical shaft, meshes into a pinion on an horizontal shaft, which carries a fly wheel. "The balance wheel is *fifteen inches in diameter,* is made very similar to the common water wheel; the diameter of it on the inside, is about 10 inches, which will, of course, make the rim of it five inches in depth, and is *two and a half in width.* The bend of the wheel on the inside and outside, is planked, so that it is hollow. This hollow is partitioned off in spaces of one inch and a quarter, and in these spaces I put *clay,* which is for the purpose of making the wheel heavier." The specification concludes thus. "What I claim as my improvement, is, the balance wheel, the manner in which it is made heavy, and the spiral springs."

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18. For a machine for *Sawing hoops, lath, veneering, staves, and heading,* and all other kinds of stuff used, or wanted by

coopers, cabinet makers, and house joiners; Isaac Price, jun., Lockport, Niagara County, New York, August 19.

The drawing accompanying the specification of this machine, gives a general, but not a particular idea of its structure. We will merely state, that there is a carriage, upon which the timber to be sawed is fixed; that there are revolving shafts, which carry circular saws, and that these saws may be placed so as to saw vertically, horizontally, or obliquely, in any required degree. What particular part of the structure is claimed as new, does not appear, the whole machine being described, without any special specification.

It is stated, that the whole machine will occupy a space of only 12 feet in length, five in width, and 3 or 4 in height, and that it may be constructed for seventy-five dollars.

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19. For an improvement in *Raising water from wells*, cisterns, and springs, for domestic purposes; Samuel Smith, Mendon, Monroe County, New York, August 20.

This resembles a pump, with a solid piston. The chamber or reservoir, is to be fixed in any place where water is wanted; a pipe, with a valve at top, leads down into the well or spring. In the description, no proportions are mentioned; in the drawing, the chamber has ten times the diameter of the suction pipe, and, of course, the water must pass through this with 100 times the velocity with which the piston ascends. To draw off the water, a cock is inserted through the lower part of the chamber; as the water is discharged, the weight of the piston, and the pressure of the atmosphere, will cause the piston to descend, and occupy its place.

The most curious part of the structure, is the mode of working the pump. The piston rod is a toothed rack, into which a pinion works. This pinion is on the same axis with a wheel of three times its diameter, and this wheel is turned by a crank on the axis of a second pinion, which is about the size of the first; the piston will, of course, rise very slowly; this is evidently intended to accomplish the labour of filling the large chamber, which is to act as a reservoir; but why a single small pinion and crank were not preferred, we do not perceive.

The water is not to be raised by alternate strokes of the piston, but by a single lifting operation, which is to be repeated, when the cistern, or chamber, is exhausted.

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20. For a method of *Casting moveable printers' types;* whereby the process is rendered practicable by mechanical means, and its expense much abridged; Wm. M. Johnson, New York, August 21.

The description of the apparatus and process, which form the subject of this patent, is of great length, occupying upwards of thirty closely written pages; besides which, there are about twenty well delineated figures, with seven pages of descriptive reference. The con-

cluding part, in which the patentee states his claims, will afford a pretty full and clear idea of the nature of the invention.

"The improvements which I claim by right of original invention are,"

"1st. The giving to the mould, by the turning of a crank, all the motions that are requisite in it in casting, viz. the opening and shutting the mould with proper force and accuracy; the raising of the matrix, and the discharging of the type; said operations of the mould being performed by means of the mechanism above described, or by any other that merely varies the form, without improving the process."

"2ndly. The performance of all the motions of the kettle apparatus, by the turning of a crank, viz. the producing and stopping of the stream of metal through an aperture in the kettle, and giving it the needful force; this operation being performed by means of the mechanism herein described, or by any other that merely varies the form, without improving the process; not intending to embrace within this claim, the use of a stopper alone, or a plunger alone, but the use of the two together, when worked by a crank."

"3dly. The use of a moveable cover, to the cavity of the mould, by means of a distinct piece coming between the kettle and the mould, to prevent the metal from overrunning it when forced into the mould; this appendage being applied in the manner afore stated, or in any other that merely varies the form without improving the process."

"4thly. The covering and uncovering the cavity of the mould (with the said cap or cover) by the turning of a crank; this action being effected by means of the mechanism afore described, or by any other that only varies the form without improving the process."

"5thly. The application of water to the mould, by a rapid dropping, or constant stream upon it, whilst casting, when worked by a crank, as afore described; and also the application of water to the cap, by the means above stated, or by any other that merely varies without improving the mode; it is not intended in the claim, to embrace the use of water to the mould in all shapes, but merely its use by a *constant passage* of it when applied to one side of the mould alone, and when applied to the cap, or to the two sides of the mould together, by any kind of a stream or passage of it, or by any means that merely varies without improving the mode."

"6thly. The combined use of the plunger with valves, and a stopper rod, in a stationary kettle, that has the fire around it; said plunger and stopper being attached to the kettle in the manner afore stated, or in any other," &c.

"7thly. The use of compressed atmospheric, or other air upon the surface of the melted metal, to give it the needful impetus into the mould, said power being applied in the manner herein described, or by any other," &c.

"8thly. The combined action of the mould, cap, stationary kettle, plunger, and stopper, or air pressure, in lieu of plunger and water, by means of a crank as afore specified, or by any other," &c. "It is intended, in this particular claim, to embrace only the *com-*

bination of the several parts, as affording, in their united operation, a new process, and a certain degree of improvement."

"9thly. The removing the mould from the kettle, in order to discharge the type by causing an immediate separation between the two, by taking the mould off from the kettle in a line with the direction of the stream of metal that is injected into the mould, or at any angle with that line, without having any sliding upon the surface of the kettle, or other friction against it, further than that produced by the taper point of the spout, in contact with the hole of the cap."

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21. For improvements on a *Boiler or steam generator;* patented on the 13th of March, 1815; Lemuel M. Richards, Chagrin, Cayahoga County, Ohio, August 21.

The patent obtained in 1815, upon which this purports to be an improvement, was principally for the purpose of generating steam for mashing and distilling. The boiler there described, is a metallic vessel, ordinarily made 7 feet long, 2 feet 6 inches wide, and three inches deep. This is built around with brick, in the usual manner; and a steam pipe ascends from it, communicating with the beer tub, doubler, &c. Two tubes extend along under the boiler, inserted into it at each of their ends, which tubes are exposed to the flame from the fuel, the better to economize heat. The furnace is in front of the boiler: the wood used is placed upon iron bars, which are themselves hollow tubes, and kept filled with water, by a supply tube into which they are inserted at one end; the other ends of these tubes pass through the brick work of the furnace, and into a tub where the water is heated for mashing. The steam, and supply, tubes, need no further description.

In the recent improvement, instead of a single boiler, there are two, one placed about 8 inches above the other, and connected together by two tubes of iron: the bars for heating the mashing water, are enlarged, and their projecting ends open out, to receive short wooden tubes, which connect them with two wooden hollow logs, which run parallel with the boiler, on the outside of the fire place. This connexion is secured by passing iron bolts, with heads and screw nuts, through the logs, the connecting wooden tubes, and the hollow bars of the grate. Wooden tubes from these logs, enter, the one through the top, and the other through the bottom, of a tub, which is to supply boiling water for mashing, &c.

The fire is placed under the lower boiler, and the flame passes back between it and the upper boiler, then over the upper boiler, and into a chimney. There is a safety tube, rising to the height of 18 feet from the upper boiler; and the manner of supplying the boiler with water has undergone some change. These are the improvements claimed.

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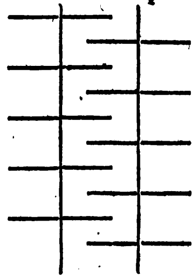
22. For the *Manufacture of entry and carriage mats* from Manilla, Sisal, and other grasses, and from hemp; Samuel S. Williams, Roxbury, Norfolk County, Mass. August 21.

[See the specification in this number.]

23. For a *Churn for churning milk and cream*; Joseph Hathaway, Canandaigua, Ontario County, New York, August 22.

There is, we believe, a real novelty in this churn, notwithstanding the great number of machines for the same purpose which have preceded it. The body of the churn is a barrel, which is placed upon one end; within this barrel there are two sets of dashers, which are made to revolve in opposite directions, and work between each other in the manner represented in the margin. There are two small whorls on the upper ends of the shafts of the dashers; there are also two larger whorls, which are turned by a crank, the bands from which pass over the smaller whorls, and turn them in opposite directions. The manner of fixing the frame, shafts, whorls, and bands, needs no description.



24. For a machine for *Planting grain, and other seeds;* Orson Starr, Richmond, Ontario County, New York, August 22.

Of this machine, the description and drawing shall appear in our next number.

25. For an improvement in the *Manufacturing or making of shingles;* Danforth Wilder, Rome, Oneida County, New York, August 25.

A circular stationary platform is erected, of 16 feet, or more, in diameter, which is the foundation, or bed of the whole machinery. A strong pivot, or gudgeon, projects up from the centre of this bed, and near its periphery there is a strong knife, placed with its edge as high above the platform as the intended thickness of the shingles. Under the edge of the knife, the platform is perforated like the stock of a plane, to allow the cut shingles to pass through. A wheel, equal in diameter to the platform, is made to revolve upon the pivot or gudgeon on the centre of the bed. This carries boxes in which the blocks, from which the shingles are to be cut, are secured. A lever or arm extends out from this wheel, to which a horse may be attached; or the wheel may be turned by water, or other power.

There are some appendages for bringing the block forward, and letting it down to the knife, which are not distinctly delineated in the drawing, or clearly explained; and the model has not yet been deposited in the office.

26. For an improvement in the *Machine for boring the earth;* John H. Failing, Canajoharie, Montgomery County, New York, August 25.

By the aid of this machinery, horse power is to be applied to the purpose of boring the earth. The horse turns a vertical shaft in the ordinary way, and by means of some ingeniously contrived apparatus, the rope to which the drill shaft is attached, is alternately drawn

and slackened so as to raise the drill about ten inches, and allow it to fall, about 60 times in a minute.

The points claimed by the patentee, are, the single ratchet wheel and lever, for tripping the drill rods; a metal valve placed at the bottom of a cleaner, which is a metal tube fitting the hole which has been bored, and let down to remove the drillings; a cast steel collar to the chisel, which collar is put on the shank of the drill before it is inserted into the socket, and projects precisely enough to cover the outside edges of the drill; and the manner of causing an endless screw to operate in the raising the rods from the earth, by horse power.

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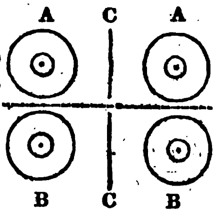
27. For a machine called a *Slitting gauge, for slitting lath, hoops, and all other kinds of stuff,* from boards, or other stuff; Benjamin K. Crandell, Lockport, Niagara County, New York, August 25.

This machine has a long flat table, or bench, mounted on a proper frame. An axis passes across, under the bed of the table, carrying at one end, a large cog wheel outside of the frame, and, a drum, or whorls, round which bands may be passed, to give motion to circular saws, &c. A A and B B, represent small cog wheels on the ends of two pair of rollers, which are fixed above, and across the table. The lower wheels B B, are turned by the large cog wheel, and these turn the upper wheels A A. The board, or stuff, to be slit, represented by the dotted lines, is passed between the rollers, and is cut by rows of knives above and below the board, as at C C. These rollers have steel or iron points driven into them, to draw the stuff through.



The stuff is sometimes prepared for slitting, by the use of a circular saw, or saws, which may be carried by straps from the drum. When these are used, a carriage is placed upon the bench; upon this carriage the stuff to be sawed is secured, and is run backward and forward by hand.

The machinery receives its motion by applying the power to the shaft of the cog wheel and drum.

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28. For an improvement in *Boot-trees;* Henry B. Miller, Mayville, Chatauque County, New York, August 25.

This improvement consists in an iron shaft which passes down the boot-tree, and has on its lower end a toothed wheel, or cylinder, which takes into a toothed rack; by turning this shaft, the back and front pieces of the boot-tree are forced apart to any desired extent. At the upper end of the shaft, there is a ratchet wheel and catch, to hold the shaft in its position, when the boot is stretched. These appear to be the essential parts of the invention.

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29. For an improvement in the mode of *Managing honey*

bees; Francis Kelsey, Lockport, Niagara County, New York, August 26. [See the specification in the present number.]

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30. For an improvement in the *construction of filters*, for separating the impurities from turbid liquors; John S. Phillips, Philadelphia, Pennsylvania, August 27.

Some additions are intended to be made to this invention, which will, probably, be the subject of a future patent, when the whole shall be particularly noticed.

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31. For an improvement in the *Mode of drawing lotteries;* J. J. Cohen, jun., Baltimore, Maryland, August 28.

The object of this improvement is, to have "a lottery composed of several drawings, each drawing, although part of, and included in the principal programm, yet independent and separate."

Suppose, for example, that the different classes of a certain lottery are to be drawn monthly, it is intended to subdivide each class, so that a portion of it shall be drawn weekly, and the whole completed in four drawings. In a case of this description, it is obviously necessary so to arrange the scheme, that an equal interest may be excited, and maintained, by each separate distribution. This is the object proposed to be attained by the exemplified scheme given in the specification. This we do not think it necessary to publish. Those interested, will learn the whole from the publications of the patentee.

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32. For a *Machine for planting different seeds;* Austin H. Robbins, and Levi Robbins, jun., Denmark, Lewis County, New York, August 28.

The drawing for this machine is in the hands of the engraver, and is expected to be ready for the next number.

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33. For an improved *Water-proof self-priming percussion gun-lock;* Samuel S. Faries, Middletown, Butler County, Ohio, August 29.

[See the specification in this number].

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34. For a *Self-regulating brake* for wagons, carts, or carriages; Robert Turner, Ward, Worcester County, Mass. Aug. 29.

This will hereafter be published with engravings. The object, as the name indicates, is to cause a brake to act, by the descent of a carriage upon a hill, or an inclined plane, so that its friction shall be proportioned to the descent, without requiring the care of an attendant.

35. For a *Machine for sawing staves*, for the construction of cylindrical vessels; Lewis R. Bump, Wareham, Massachusetts, August 29.

This machine consists of a hollow metallic cylinder, or tube, of the diameter of the intended hogshead, cask, tub, bucket, &c., and somewhat exceeding it in length; one edge of this cylinder is toothed, so as to form a saw; the other end is closed by a cylindrical piece, or head, fitted firmly into it; into the centre of this, an axis, or shaft, is fixed, which passes through, and beyond, the axis of the cylindrical saw. Upon this axis the saw is made to revolve. The timber to be sawed, is fixed upon a proper carriage, and cut both convex and concave, by being forced up against the saw.

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36. For an improvement in the mode of *Manufacturing paper on machines*, by combining two or more thicknesses of paper into one sheet; Richard Waterman and George W. Annis, Providence, Rhode Island, August 30.

See the following specification.

SPECIFICATION OF AMERICAN PATENTS.

Specification of a patent for an improvement in the manufacture of paper, by combining two or more thicknesses of paper in one sheet. Granted to RICHARD WATERMAN, *and* GEORGE W. ANNIS, *Providence, Rhode Island, August 30th.*

THIS improved mode is applicable to any machine for making the web, or endless sheet paper, so called, and is specified and described as follows:

A sheet, or web of paper is first made in the usual manner, except that it is wound upon a cylinder, or reel, either attached to, or suspended over the machine, above the press rollers, and also above the one ordinarily used as a receiving cylinder, or reel, in making single paper, on machines; and similar in construction, and dimensions thereto, but revolving in an opposite direction.

The upper cylinder, or reel, being fitted, either a lever, weighted strap, or spring, is made to bear on the surface of the cylinder, or reel, or on a pulley attached to it, with weight, or force, sufficient to regulate its motion while the paper is unwound from it; the end of the sheet is then conducted, so as to come in contact with the stuff, or unpressed paper, as it lies in the felt, before it has passed between the press rollers. The double sheet being thus formed, passes between the press rollers, and is wound upon the cylinder, or reel, ordinarily used in making single paper, and is afterwards treated and finished in the same manner as single paper.

On the same principle, paper of any number of thicknesses may be made by removing the lower cylinder, or reel, with the double sheet on it, to the place of the upper cylinder, and the upper cylinder to

the place of the lower cylinder; by conducting the double sheet on to the stuff, or unpressed paper, as it lies on the felt, in precisely the same manner as above described, paper of three thicknesses will be produced: and by repeating the process of thus shifting the two cylinders, or reels, a thickness will be added to the paper at each charge.

Richard Waterman.
George W. Annis.

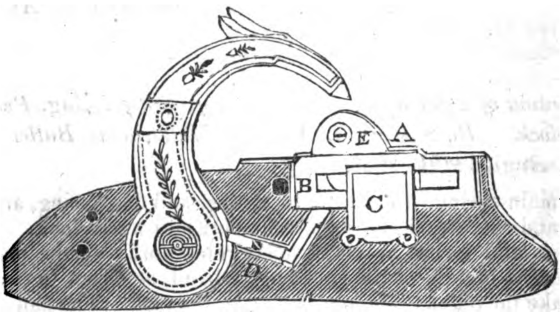
Specification of a patent for a Water-proof, Self-priming, Percussion Gun-lock. By Samuel L. Faries, *Middletown, Butler county, Ohio, August 29th,* 1828.

The main-spring, bridle, tumbler, dog, and dog-spring, are made, placed, and operate, similar to a common English gun-lock. The cock is of iron, and forms nearly a semicircle, works on the right side, and near the middle of the cock, has a bend, or offset, to the left, so as to make the percussion point strike in the pan. The pan is on the top of the lock, and in a plug, having a bush-screw to enter the right side of the gun barrel, near the breach, and through which bush-screw is perforated a hole, or fuse, communicating with the pan and the inside of the barrel; and set in a square notch, in the upper edge of the plate or side piece, which plate may be brass, iron, steel, or silver, at discretion. On the top edge of the plate, is placed a "priming cap," which may be made of either brass, iron, steel, or silver, nearly semicircular on the top, flat on the underside, having a hole therein, a little forward of the centre, and made to contain a half thimble full, more or less; which priming cap is attached to a plate, having a side plate or slide, which slide has a horizontal aperture in the middle, about an inch long, and one-eighth of an inch wide; this slide and cap are attached together, and kept in their place by means of a bridle, screwed on to the outside of the main plate, and which slide and cap are moved backwards and forwards, by means of a right angled lever confined to the main plate, the angle projecting forwards; to the outside of the upper leg of the angle, is a small and short pivot, placed to run in a groove, which groove is perpendicular on the inside, and near the end of the side plate of the priming cap; the end of the lower leg of the angle is rounded, and placed in a semicircular mortice, near the lower or but-end of the cock, and which right angled lever is confined to the main plate of the lock by a screw, through it, near the middle of the lower leg of the lever. There is also a screw entering the right side of the priming cap, for the admission of priming powder; hence, when the lock is half cocked, the pan is covered; when it is whole cocked, the priming fills the pan, and when the trigger is drawn, the priming cap is drawn back from over the pan, and the percussion point strikes in the pan, and fire is produced. The claim therefore of this applicant is, that he be secured in his invention of the cock, priming cap,

and slide, right angled lever, bridle and plug pan, with the bush-screw attached, as before described, to be used, in connexion with the main-spring, bridle, dog, and dog-spring of a common English gun-lock.

S. L. Faries.

Samuel L. Faries' Percussion Gun-Lock.



A. Priming cap.—B. Slide part of do.—C. Bridle.—D. Right angled lever.—E. Screw which closes the hole, by which the chamber is filled with priming powder.

Remarks by the Editor.—There is in the patent office, one of the above locks deposited as a model, by the patentee. It was sent with the chamber filled with priming powder; on essaying it, one hundred and ninety-nine full and perfect explosions were produced, before the contents of the chamber were exhausted. The discharges were certain, there being no failure excepting when the lock was held in such a position, that the priming powder could not fall into the touch hole. The outside dimensions of the semicircular chamber in this lock, are as follows: length $\frac{5}{8}$ of an inch; height $\frac{3}{8}$; depth, scant $\frac{1}{2}$ inch.

Specification of a patent obtained for a newly invented, or discovered mode or art, for the care and rearage of honey bees, being a mode by which the honey may be taken from the hive; and a new swarm separated from an old one, without injury to either. By Francis Kelsey, *Lockport, Niagara county, New York, August* 26, 1828.

FIRST METHOD OF SEPARATING.

For the purpose of separating a new swarm of bees from an old one, when sufficiently numerous, 1st. Raise the hive a little, and blow into the hive a small quantity of smoke, (tobacco smoke being preferable,) which renders the bees docile and harmless, so that they may be managed with perfect safety. 2nd. Remove the hive from the flooring, or other place on which it stands—turn it bottom

upwards upon the ground—place over the hive a sheet, or other cloth, and a sufficient thickness of cloths, to render the hive dark; a slight hammering or thumping is then to be made upon the ends of the sticks which run through the hive, which will start the bees from the centre of the hive; the hammering is then to be continued upon and about the hive, near the ground. The bees will, by this means, be driven to the top, and attach themselves to the sheet—the sheet is then to be raised from the centre of the hive; the sheet must be raised from the hive slowly and gradually, and as fast only as the bees will follow it up, the hammering upon the hive to be continued. The bees in 10 or 15 minutes will nearly all be attached to the sheet, when it is to be removed entirely from the hive, and spread upon the ground; one end of the sheet is to be raised upon a block, or other substance, about one foot high. 3d. Place an empty hive upon the raised part of the sheet, on the block; place a few bees near the empty hive, they will run into the hive, and their noise will attract the others. They then are to be allowed to run into the empty hive, until a sufficient portion of them have taken possession of the new hive, and until the queen bee is discovered, if practicable. The bees are to be made to pass into the new hive slowly, by removing the hive a proper distance from them, which affords a better opportunity of discovering the queen bee; they may also be made to go slowly by partly covering them with a cloth. The queen bee may be known by the darkness of her colour, and the brisk movements of the other bees about her, and the slowness of her movements. 4th. If too great a proportion of the bees should have passed into the new hive, the queen is to be taken and safely kept, until the swarm can be separated, and properly apportioned, when the queen bee is to be returned to the new hive. 5th. The remainder of the bees are to be returned to the old hive, where they will provide themselves with another queen bee. 6th. After the swarms are properly apportioned, the hives are to be placed upon their stand, where both swarms will commence the labours of the season.

SECOND METHOD OF SEPARATING.

The hives are to be made of a size, and of wide boards, and about twelve inches square; two sticks are to be placed each way through the centre. Seats are to be put under and near the top board, within half an inch of each other. Some time before the hive shall be filled by a swarm of bees, another hive of the same size is to be placed under it, without a top board, but with seats. The comb will be fastened to the seats. When the lower hive is full, they are to be separated; when the under hive is to have a top board attached to it by cleats; the cleats to run one and a half inches above the side boards, the better to accommodate another hive. This process may be continued from time to time, as may be deemed necessary.

The first of the above methods is preferable. The honey may be taken from the hives by either of the above modes; either by removing a part of the honey, and dividing the bees, as above described; or, by placing all the bees in the new hive, and removing all the honey.

Francis Kelsey.

Specification of a patent obtained for manufacturing entry and carriage mats, from Manilla, Sisal, and other grasses. By Samuel S. Williams, *Roxbury, Norfolk county, Massachusetts, August 22nd,* 1828.

The following is my method of manufacturing entry and carriage mats, from Manilla, Sisal, and other grasses, and hemp, in a common loom. The reed with from five to ten dents to an inch, according to the fineness of the work; the warp of single twine, two threads in a dent; the harness in four shafts, to divide the warp into four equal parts, with four treadles; the weaving is done as follows. Two or three inches of cloth is wove in the usual manner, to secure the end of the mat; one thread of hemp, flax, or tow filling, from one-eighth to one-quarter of an inch in diameter, is then thrown across; (all the above is done with two shafts up, and two down;) one more shaft must now be brought down, which leaves three parts of the warp down and one up; one thread of Manilla, Sisal, or other grass, or hemp, from one-eighth, to three-eighths of an inch in diameter, with just twist enough to hold it together, is then passed through the division of the warp, and drawn up between the threads, and wound round a rod, from one to two inches wide, according to the height the pile may be wanted. (The rod must have a groove in the top, for a guide to the knife in cutting the pile, which is done while the rod is in.) The two shafts that were up when the first thread of large filling was thrown, must now be brought down, and from one to four threads of the same must be wove in, to secure the work, and make room for the next row of Manilla, &c. The same process will be repeated every row, till the mat is the length that is wanted; the last end will be secured the same as the first. The mat is finished by hemming the ends, and shearing the pile.

Samuel S. Williams.

Specification of a patent for an apparatus for the cure of crooked, or inflected spine. Which apparatus is denominated the Dormant Balance. By James K. Casey, *of the city of New York, June 23d,* 1828.

I, the said James K. Casey, have invented, constructed, made, and applied to use, a new and useful improvement in machines, or apparatus hitherto used, for the cure of crooked, or inflected spine, in the human body, consisting of various instruments, to be denominated the Dormant Balance. The pressure of this Balance is of gradual operation, overcoming the deformity by a firm, but slow, and uniform exertion of its form. It works in a single direction until the irregularity it opposes is overcome, when the power of the machine ceases, and the balance of course becomes dormant. The plane in its inclination may be increased, or reduced, at pleasure, by the pullies; and the straps, and rigid curves, acting in a direction opposite to the

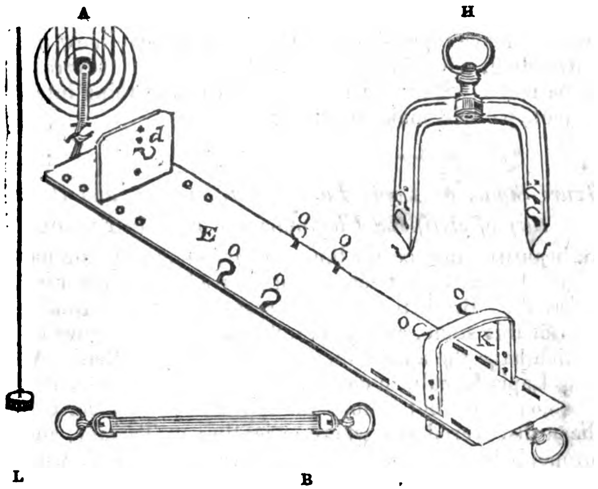
flexure of the bone, have a constant tendency to preserve each successive accession towards a straight spinal column. From a correct construction and application of this apparatus, no pain or injury can possibly accrue to the patient, whose growth, if young, it will greatly aid.

Connected with the Dormant Balance, and of essential importance, is a preparation expressly made for the purpose, to be called the linamentum spinale.

For a minute description of the structure and application of the whole apparatus, I refer to the drawing itself, and the written references, which will be found thereon.

JAMES K. CASEY.

JAMES K. CASEY'S DORMANT BALANCE, FOR THE CURE OF INFLECTED SPINE.



The figure A, is a curve made of brass or steel, to fit or go over the head, fastened at the back in the hooks, and through the holes, by a leather, or strong strap, marked B, and joined by the ring O, to the hook *d*, on the inclined plane E, which, with the patient on it, is raised, or reduced, at pleasure, by the pulley H. The curve K, at the foot of the inclined plane, affords, at the top, a hold to the toes, whilst, at the bottom, the heels pass down, and thus by a slow, but constant and regular gravitation of the body, the curvature of the spinal column is diminished.

The ring L, at the bottom of the inclined plane, is used to raise the foot of the plane, so as to make it swing in the manner of a hammock, by which means an unaltered gravitation is preserved, whilst with the smaller hooks, marked *o*, on the plane and lower curve, the patient is secured in a firm, straight, and direct position, which is necessary to the perpendicular action upon the spine.

The linament is applied by gentle friction to the whole column of the spine, before the patient is placed on the inclined plane, giving energy, as well as elasticity to all the vertebræ of the back bone.

JAMES K. CASEY.

Remarks by the Editor.—In the list of patents, p. 137, of the present volume, we noticed the favourable opinion of a gentleman well qualified to judge of the value of this apparatus. This gentleman is a distinguished anatomist and physiologist; and from a careful examination of the principles involved in the action of the apparatus, we think, that very sanguine anticipations of its usefulness, are fully justified.

By a letter from the patentee, we learn that his attention was first led to the subject by the situation of his own daughter, on whose account he had been induced, at an enormous expense, to procure from Europe all the most celebrated instruments, invented for the cure of the disease in question; but they had all fallen far short of the happy contrivance above represented. He is, we believe, now in Philadelphia, attending, with the assistance of his lady, to several male and female patients. Should we hereafter hear any thing interesting on the subject, we will make it known.

On Azure Stone, or Lapis Lazuli, Ultramarine, and the manufacture of Artificial Ultramarine. By the Editor.

THE beautiful and costly blue colour, known by the name of ultramarine, has always been manufactured from the rare mineral Lapis Lazuli. But little is known respecting the original geological situation of this stone, as it is found generally in masses of no large size, which have the appearance of having been rolled. A stone resembling Lapis Lazuli, in colour, has been mistaken for it, in several different countries, but it does not appear, by any clear evidence, to have been discovered any where excepting in Tartary, and Siberia. In Europe, it is found only under the ruins of Rome, where it was employed to decorate palaces and temples.

It was formerly believed that Persia furnished the largest portion of Lapis Lazuli, as it was much used in that empire, but it now appears probable, that their whole supply is procured from Great Bucharia, in Tartary. The information given of the manner in which it is there found, is, if correct, very peculiar; it is said not to exist in veins, but to be disseminated in granite in all sorts of proportion, but that it is a rare occurrence to find a mass of six inches in thickness, in which the blue colour predominates throughout. Laxmann, who resided several years in Siberia, says, that rolled pieces of Lapis Lazuli, are found on the shore of the great Lake Baikal; but he was unable to discover, or to learn from the Tartars, any thing respecting the mountain from which these pieces had been detached.

Lapis Lazuli takes a good polish, and is used for various ornamental purposes. It was formerly much employed in the works of the goldsmith and jeweller, particularly as a setting in the tops and

sides of gold boxes and cases, but of late years it has not been fashionable. The most profuse use of it was made by the late empress of Russia, in building a palace at St. Petersburg for her favourite, Orlof. Some of the apartments were completely lined with this costly stone. Those pieces are deemed the most perfect, which are of a uniform, vivid blue colour; and those which have a considerable mixture of quartz, are the least valued. Veins and spots of iron pyrites, of a brilliant gold colour, frequently abound in this stone; which veins are, by the ignorant, mistaken for real gold; for Mosaic, and panel work pieces thus ornamented, are much esteemed; the painted, and other imitations of Lapis Lazuli, have generally followed this kind for their type.

The most extensive use of Lapis Lazuli, in Europe, is in the manufacture of ultramarine; a blue colour, which is at once delicate, pure, and unchangeable. The process followed to obtain this colour, appears to be altogether inartificial, and must undoubtedly have been the result of accident; it is as follows. The stone is made red hot, and then thrown into cold water; after this has been repeated three or four times, it becomes extremely friable, and is to be reduced to an impalpable powder, in an iron, or rather in an agate, mortar. One pint of linseed oil, one pound of bees' wax, one pound of turpentine, half a pound of rosin, and half a pound of mastich, are to be put over the fire, gently heated, and stirred, until the mass is perfectly incorporated. When wanted, a lump of this mass is to be melted, and poured into a warm, clean mortar; one half its weight of the pulverized Lapis Lazuli, is to be incorporated thoroughly with this by means of a pestle; warm water is then to be poured in, and the whole worked about as before; this water when it assumes a dirty appearance is to be thrown away, and a fresh portion added, which will, by continuing the working, become charged with the blue colour; this is to be poured into a clean glass vessel, and the washing and pouring off continued until the extrication of the colour ceases. In a few days the ultramarine settles, and the clear liquor is drawn off.

The colour of ultramarine has been supposed to be derived from oxide of iron. In vol. v. p. 201, we gave a translation of some notices by M. Pajot Descharmes, of certain properties of iron, the last of which is, on '*glass coloured blue by iron.*' The tritoxide of iron being mixed with sulphate of soda, and sub-carbonate of soda, gave to the glass which this mixture produced, a blue colour. The writer suggests, that this fact might lead to the manufacture of artificial ultramarine. In the nature of the thing, there was no known reason why this should not be effected, and men of science have been so convinced of the possibility of the thing, that for four years in succession, the *Société d'Encouragement* of Paris, have offered a prize of 6000 franks for its fabrication.

In the Baron Ferrusac's Journal, for April last, there appeared the following notice. "M. Gay Lussac announced to the Academy of Sciences, at its sitting, on Monday, the fourth of February last, that M. Guimet, inspector of the gunpowder and saltpetre works,

has lately manufactured every kind of ultramarine, and had obtained it, by his process, *of a finer, and more brilliant colour, than the real ultramarine.* It was by following the analysis obtained by MM. Clement and Desormes, that he attained this fortunate result.

"M. Guimet has already sold his ultramarine to the public at twenty-five francs per ounce, (this colour has hitherto always cost from fifty to sixty francs the ounce) and it is expected, that he will be able to afford it at a still more moderate price. The inventer has thought proper to keep his process a secret for the present."

The analysis by MM. Clement and Desormes, which is referred to, is that of Lapis Lazuli, which afforded the following result.

Silica - - - - - - -	34.
Alumina - - - - - - -	33.
Sulphur - - - - - - -	3.
Soda - - - - - - -	22.
Loss - - - - - - -	8.
	100.

In the *Annales de Chimie*, for April last, another gentleman, M. Gmelin, states that he had been for many months engaged in experiments on the manufacture of artificial ultramarine, in which he seems to have succeeded perfectly, and appears to think that his researches had produced those of M. Guimet, and as he had determined to keep his process secret, M. Gmelin has made public that which he has discovered. The following is a translation of this part of his paper.

"The process by which ultramarine may be prepared with infallible success, is as follows:

"The hydrate of silica, and of alumina, are to be obtained; the first, by fusing well pulverized quartz, with four times its weight of carbonate of potash, and then dissolving the fused mass in water, and precipitating the silica by muriatic acid; the second, by precipitating it from a solution of pure alum, by ammonia. These two earths are to be carefully washed with boiling water; the quantity of dry earth may be ascertained, by heating a certain quantity of the humid earth, to redness. The hydrate of silica, which I used in my experiments, contained 56, and the hydrate of alumina 3.24 parts of anhydrous earth, in 100 parts.*

"As much of the hydrate of silica is then dissolved, as can be taken up by a heated solution of caustic soda, and the quantity of earth dissolved, ascertained. To 72 parts of the anhydrous silica, a quantity of the hydrate of alumina is added, amounting to 70 parts of the dry alumina; the moisture is then evaporated from the mix-

* We have given these numbers as we found them in the original, but there must be some error; well dried hydrate of alumina, consisting of about equal parts of alumina and water. As the hydrate used was humid, the correction should probably be 32.4, instead of 3.24.—[*Editor.*

ture, stirring it constantly, until it is brought to the state of a humid powder.

"This combination of silica, alumina, and soda, is the basis of the ultramarine; but which yet requires to receive its tint from sulphuret of sodium, which is effected in the following manner:

"Into an Hessian crucible, furnished with a good cover, there is to be put a mixture of 2 parts of sulphur, and 1 part of anhydrous carbonate of soda. This is to be gently heated until it is slightly red, and the mass is perfectly melted; into this the former mixture is to be thrown in very small portions at a time, and permitting the effervescence arising from the vapour of water to cease, before a fresh portion is added. After having allowed the crucible to remain in a moderate red heat for an hour, it is taken from the fire, and suffered to cool. It now contains the ultramarine, mixed with an excess of sulphuret, which last is separated by means of water; if there be yet sulphur in excess, this may be driven off by a moderate heat. Should the ultramarine be unequal in colour, the finest and most perfect portion may be separated by washing with water, after having reduced it into a very fine powder."

In a note addressed to M. Gay Lussac, by M. Guimet, on the subject of M. Gmelin's publication, he makes the following observations. "The publication of the process of M. Gmelin, will undoubtedly be advantageous to science; but I much doubt the possibility of procuring the ultramarine by his method, at a reasonable price; of this, time must be the test. For myself, I have the satisfaction of making improvements in my process, daily, and of obtaining, at a diminished expense, ultramarine of the finest quality. I am likely to be able to furnish whatever is required in the arts, having obtained the necessary apparatus, and being aided by an able assistant."

M. Guimet repels the idea of his having derived any information from the inquiries of M. Gmelin. It, in fact, appears pretty evident, that these gentlemen have each discovered a mode of manufacturing ultramarine; but of the similarity of their processes, we have, at present, no means of forming a judgment.

A Notice of some errors in the History of Barker's Mill, as given in Nicholson's Operative Mechanic, and in the Franklin Journal.

TO THE EDITOR OF THE FRANKLIN JOURNAL.

Sir,—Being a constant reader of your valuable Journal, I met, in your number for July last, with the description and history of the mill called Dr. Barker's. About three years ago, my attention was called to the subject, by the account given of that machine in Nicholson's Operative Mechanic; and being at that time about erecting a mill for the purpose of pulverizing drugs, and performing other chemical manipulations, I had thoughts of trying Dr. Barker's. I consulted different books, in hopes of finding more facts relating to its

use in practice: at length I found Dr. Desagulier's Course of Experimental Philosophy, in the library of Harvard College, which is the work to which Nicholson and others give credit, for the first account of this mill; and saw, to my surprise, that the history given of it, and which is copied in the 7th page of your fifth volume, is entirely incorrect, of which you can satisfy yourself by referring to Desagulier's work, Vol. I. page 453, third edition. He states, indeed, that "now by Dr. Barker's improvement, the waste water only from Sir George's ponds, keeps the mill constantly to work;" but the fact is, that the improvement was not the introduction of the mill commonly called Dr. *Barker's*, but merely the *Breast Mill*, with the buckets running in a circular trough, contiguous to the periphery of the loaded quadrant of the wheel. I now quote Dr. Desagulier, omitting only the references to the engraving. "This wheel is 19 feet in diameter, with 12 arms and 24 ladle-boards, and is so contrived, that the ladle-boards receive their water a little above the horizontal diameter of the wheel, and do not part with it till they come to the lowest part of the wheel under the centre, where the water would not only be ineffectual, but hurtful to the motion. The contrivance to effect this, is as follows: there is a circular channel, reaching from the level of the wheel's centre, quite to the under part, exactly square within; that is, the section made through this channel by a plane passing through its wheel's centre, is every where a square of 18 inches the side. The ladle-boards, being 18 inches long and 18 inches broad, just pass down this channel without touching, and scarce lose any water at all (the little that slips by the first, going to the second) in going round a quarter of the wheel," &c. It is by no means strange, that a Breast Mill, of considerable diameter, and adapted to make the most of the water without wasting any, should have been of such signal service to Sir George Savile's ponds.

The true history of the machine that now goes by Dr. Barker's name, may be found in the 459th page of the same volume. Dr. Desagulier says, that "where there is a fall of water, not sufficient in quantity to turn even an over-shot mill; supposing this fall to be of 16, 20, or 30 feet; it is possible to make it turn a new invented mill, the most simple that ever was made; without wheel, trundle, cog, or round. Dr. *Barker* had this thought, and communicated it to me, saying, that it would be an experimental proof of M. Parent's proposition [that an under-shot water mill does most work when the water-wheel moves with only a third part of the natural velocity of the water that drives it.] I took the doctor's hint, and made the following working model of it, which I showed the Royal Society the experiment of, at their last meeting this summer." From the above extracts it appears, that in Desagulier's time, Barker's centrifugal mill had not been tested, except by a working model, and that Barker's *Breast Mill*, did the work for which the former has had the credit. This is not the only instance I have met with, of carelessness shown by the compilers of scientific works, copied by one from another, until it is almost impossible to find with whom the error first originated. The error which I have stated, if not cor-

rected, might induce some person, as it nearly did me, to expend time and money, which might possibly end in disappointment. I have conveniences for trying experiments, and intend, when leisure permits, to try some with the Centrifugal Mill, for which I have made some preparations—the result shall be communicated.

S. C.

Newtown, Mass. Sept. 1828.

Remarks by the Editor.—We are much obliged by the foregoing remarks of our correspondent. We have not Desagulier upon our shelves, but have no doubt whatever of the correctness of the preceding statement. The detection of an error of this kind, is, in our estimation, a thing of no small importance; we have examined several other books, in which the mistake complained of, is propagated, and have not met with one in which the facts have been correctly stated. It has been the determination of the Editor, to write an article upon the subject of Barker's Mill, and if our correspondent will turn to our preliminary remarks, p. 2. in the July number, he will find this intention expressed, and also some opinions given, calculated to discourage the *expenditure of time and money*, on a mill of this description. In the last edition of *Evan's Millwright and Miller's Guide*, which was revised by the Editor, a similar expression of his opinions respecting this mill, may be found.

It is much to be regretted, that in the *art of book-making*, there is, in general, so little industry used, that an error committed by a first compiler, stands a fair chance of perpetual succession, as it is almost sure to be fostered by the next, and the next, and the next in turn. Every man of science has experienced the truth of this to his cost. Whether we should have detected that which has been pointed out by our correspondent, we do not know; the promised article, however, would not have been written without consulting Desagulier's work, as one of the objects which we had in view, was to ascertain the respective merits of Barker, and of Rumsey. The article in our July number, was a continuation of a series of essays from a foreign journal.

We hope S. C. will fulfil his promise.

On the Combination of a Practical with a Liberal course of Education. By W. R. JOHNSON, *Principal of the High School of the Franklin Institute.*

No. IV.

THE description of the interior arrangements, the furniture and apparatus employed in conducting the institution, whose course of study has been already discussed, next claims attention. The importance of convenient accommodations, for the management of a school, cannot be too highly estimated. The duties of government and instruction, which, in the schools of our country, generally de-

volve on the same individuals, are sufficiently arduous, without any additional vexations from narrow, crowded apartments, imperfect ventilation, deficiency of light, or the ill contrivance and bad arrangement of desks and other furniture. The haggard looks of teachers and pupils, subjected to the influence of such circumstances, often testify that these are, literally, affairs of vital consequence.

No profitable exercise of mind, can be expected, where the bodily functions are either suspended or imperfectly performed. It is to be feared that health, and comfort, and the love of learning, are often sacrificed to the cupidity which seeks to make a pecuniary saving, by crowding large numbers into small spaces. These considerations will excuse more minuteness in this description, than the general reader would, perhaps, deem necessary.

Though the apartments, in which the High School is at present held, are by no means the best which could be devised for its accommodation, yet no other equally commodious, have been found, in a situation which would render them, on the whole, desirable. The want of suitable grounds, in the neighbourhood of the building, to admit of gymnastic exercises, is felt as an inconvenience, which ought, if possible, to be remedied, in providing a future location.

To have all departments of the school under the same roof, is likewise important to the interests of the establishment, as it affords an opportunity for more frequent and intimate inspection, by the principal, into the operations of all the classes. A good lot of ground, on which suitable buildings may be erected, with special reference to this object, is a *desideratum.*

The hall of the Institute, in south Seventh-street, of which the third floor is appropriated to the High School, is about 98 feet in length, and, for about twenty feet at the two ends, it is 58 feet in breadth, while the middle portion is narrowed to forty-two. This central portion is, internally, fifty-six feet in length, and forty in breadth, and affords the principal apartment for the accommodation of the school. This apartment is called the *study room.* Of the other two portions, one is appropriated to those pupils who pursue only English studies, and are considered as *preparing* for the regular course. The other is used solely as a *recitation room* for the pupils of the High School department.

Three passages, each six feet in breadth, connect the *study* and *recitation* rooms, and render them essentially one apartment. In the central passage, the master's desk is placed, affording, from a platform elevated about two feet, a view of all the classes, whether at study or recitation. The benches and desks of the study room, are so placed, that the faces of all the scholars are directed to that end where the master's desk is situated. Each desk is three feet eight inches in length, by 18 inches wide, and each bench 3 feet 4 inches long, and 11 inches wide, intended to accommodate two scholars.

Each bench is firmly attached to the front of the desk, immediately behind it; and the whole space from front to rear, occupied by each bench with its desk, is two feet nine inches.

Each desk is furnished with two slates, which are considered part of the permanent furniture.

The passages which run from front to rear, between the ranges of desks, are 17 inches in breadth, allowing every scholar to arrive at his place, without passing behind, or interrupting any other. The central passage has double the breadth of the others, and a space five feet wide, unoccupied by desks, extends around the room near the wall.

In the *recitation room*, are nineteen semicircular benches, each of five feet exterior diameter, and seven inches wide, lengthened, however, by the addition of one foot at each end to the semicircular part. The benches are arranged round the room, the concave part being turned towards the wall, within about 2 feet of which the ends are placed; leaving a passage of that width, quite around the apartment. At each of these semicircles, seven pupils can be conveniently accommodated for recitation, who sit round a small table 20 inches square, facing the centre, where the monitor's bench is placed.

Behind each monitor's bench, a black board, about 4 feet long and three and a half wide, is suspended against the wall, at such a height, that operations performed upon it, may be seen by the teacher in the centre of the room, as well as by all the pupils who sit at the semicircle. In the two feet passage between the range of semicircles and the wall, is a bench, on which a large class is seated when called out for examination or for recitation to a master. In such cases the nineteen black boards are frequently put in requisition at the same time, as the eye of the teacher by passing from one to another, readily detects any error which may occur in the operation to be performed.

Besides these arrangements for recitation, ten semicircles are placed on one side of the *study room*, in the space near the wall, not occupied by desks. In the same apartment, at the end opposite the master's desk, are several cases containing books of reference, and apparatus for different purposes.

For the aid of scholars well advanced in the *languages*, an open book-case is placed in the *study room*, containing an ample supply of dictionaries, among which are Hendericus' Greek Lexicon, Ainsworth's quarto Latin, Johnson's English, Boyer's French, Ludwig's German, and the Academy's Spanish Dictionaries, Crabb's Technological Dictionary, Crabb's English, and Dusmenil's Latin Synonymes, Adam's and Kennett's, Roman, and Potter's Greek Antiquities, Lempriere's Classical Dictionary, and many other books of a similar character.

For the occasional use of students in *elocution*, the works of several eminent writers on the subject, and collections of speeches, and other compositions adapted to the purpose, are placed within the reach of the pupils. Some works in this department are still wanting, which it is hoped may, in due time, be supplied.

In *natural philosophy and chemistry*, the apparatus is already respectable, and for illustration in some particular departments very ample.

The electrical machines, batteries, and other apparatus belonging to this establishment, are believed to be inferior to few collections in the country. A set of electro-magnetic instruments will, in due time, be added. The pneumatic apparatus is, likewise, unusually excellent. A good set of mechanical powers, and a number of astronomical instruments, are still wanting.

The school is furnished with a pair of 9 inch terrestrial globes, suitable to be used by monitors in teaching their divisions, a pair of 18 inch globes, and a third pair, 24 inches in diameter, chiefly used for astronomical problems. It has, on rollers, large maps of the *world*, of the *four quarters*, of the *United States*, *Pennsylvania*, *Western States*, *South America*, &c.; a box of sixty small maps on paste board, by Finley, and a similar collection of ancient maps, by Tanner, besides the elegant American Atlas, by the latter publisher, and the general school atlas, by Morse. Several copies of Worcester's Gazetteer are deposited in the book-case, to be freely consulted by the pupils in preparing their exercises and solving problems. In the department of geography, the above materials, in addition to the text book of the school, have, generally, been found sufficient for all the purposes of the establishment; but some additional volumes for reference, and a few other maps, charts, and atlases, would, occasionally, be useful.

In the department of *drawing*, the school is supplied with a collection of upwards of thirty original patterns, executed by Mr. W. Mason, in Indian ink, on large map paper, each 31 inches in length, by 24 in breadth, and each including some class of tools, implements, furniture, or utensils, represented in bold lines, easily distinguished at the distance of 50 or 60 feet. These constitute a series of exercises in linear drawing, graduated from very simple and easy, to very complicated and difficult.

There is a neat collection of patterns, in the elements of landscape and figure drawing, consisting of about 120, each 12 inches by 8, likewise graduated and numbered, from the easier to the more difficult subjects. Patterns in natural history and architecture will soon be added to these collections.

In the department of *machine drawing*, the models and apparatus belonging to the school, furnish abundant subjects of all degrees of difficulty.

The teachers have supplied themselves with collections of standard works on the subject of education, which are, occasionally, offered for perusal to young teachers and monitors, to aid their practice, and establish their principles in the business of instruction. The journal of the Normal schools of France, the works of Bacon, Comenius, Locke, Dumarsais, Knox, Rollin, and many others, are frequently referred to, either for general hints, or for practical illustrations of the methods of teaching in the several departments.

On a new variety of Borax, (Borate of Soda,) possessing properties which render it valuable in the arts, and particularly to jewellers. Abstracted from a memoir in the *Annales De Chimie*, for April, 1828. By the Editor.

The memoir alluded to in the title, is, in great part, devoted to an examination of the claims of M. Buran and M. Payen, to priority in the discovery of the new variety of borax, which is the subject of this article. This discussion we omit altogether, and proceed at once to give an account of the useful properties, and the mode of preparing the substance in question.

The artisan, for whose benefit we professedly write, frequently complains that we use the terms employed by the scientific chemist, and do not call things by their common names; and perhaps, our present labour may be thought liable to the same objection. We think that it is a sufficient answer to this complaint, to say, that bodies are known to the chemist in forms and states, in which they have no common name, and that there is, therefore, no choice left, but to mention them by the only name which has been given to them, or to leave them unnoticed. In the present instance, as in numerous others, whilst we introduce terms unknown to the generality of our artisans, we furnish him with the means of preparing that which may be of use to him, although we may not instruct him as regards the play of affinities, and the combination of the atoms, which constitute the new substance.

Jewellers, and other fine workers in metal, prepare their borax for soldering, by rubbing it upon a piece of flat stone, generally a slate, with a few drops of water, in order to reduce it into very fine particles. The ordinary borax is apt to crumble at the edges, in this operation, and small fragments thus become mixed with the finer parts, producing not merely inconvenience, but sometimes causing the metal to melt in considerable portions, to the great loss of the workman. Borax in the new form is entirely free from this defect, for, whilst it is not too hard to rub freely upon the stone, it is sufficiently solid and tenacious to prevent the crumbling so much complained of.

The new species of borate of soda, differs chemically from the ordinary kind, in the quantity of water of crystallization which it contains, this being precisely one-half. This difference in its chemical constitution, is accompanied by corresponding differences in its other properties. Instead of crystallizing in the form of a prism of four or six sides, it assumes that of a regular octahedron. Its density is very much increased, and there is a similar augmentation in its hardness. The common, or prismatic borax splits in pieces when exposed to a temperature of 120°; the octahedral remains solid when thus exposed. Common borax retains its transparency in a moist atmosphere, or when immersed in water, whilst in a dry air, it becomes opaque, in consequence of its efflorescing on its surface. The new kind, on the contrary, becomes opaque when affected by moisture,

but remains transparent in a dry situation. To the chemist, the cause of these differences needs no explanation.

The following is the mode of obtaining the octahedral borate of soda, practised by M. Payen. Borax is dissolved in water at the boiling point; the quantity dissolved should be such as will give to the boiling hot liquid, a density of 30° of the hydrometer of Beaumé, which is equal to a specific gravity of 1.26. This will probably require 7 or 8 parts of water to 1 of borax; this, however, is a mere guess, as we have not made any certain experiments, or calculations on the subject. The solution is then allowed to cool quietly and slowly; when it has descended to nearly 170°, it will begin to deposit the octahedral crystals, and will continue so to do, until it arrives at 132°. At this point, the uncrystallized liquid, or *mother-water*, must be poured off. If this be not done, the whole operation will fail, as the octahedral crystals will become coated, and united, by borax in the ordinary state, which is deposited as the liquid descends to a lower temperature.

The process of M. Buran differs somewhat from the foregoing, and is calculated only for operations in the large way. His solution is made rather more concentrated, being equal to 32° of Beaumé's hydrometer, or about 1.28 sp. g. He then covers the boiler, so as to cause the solution to cool as slowly as possible. If operating upon 1000lbs. of borax, it is allowed to remain about 6 days, when it is opened, the liquid drawn off, and the mass of borax taken out. The crust which was last deposited, is of the prismatic kind, this is detached by means of a hatchet, from the dense deposit of octahedral borax.

The new kind of borax is intrinsically of much greater value than the ordinary kind, leaving its utility in the arts out of the question. This will be readily understood, when it is known, that the water of crystallization in the latter, amounts to nearly 50 per cent., whilst the former contains but half this quantity. Under the same weight, therefore, we are presented with a much larger quantity of borax.

In presenting the two processes to our readers, we have, in the first, offered to the jeweller the information necessary to enable him to operate upon a small quantity for his own use; and by the second, the manufacturer may supply the market with an article which will always be preferred, where its superiority is known.

Description of a new parallel motion for Steam Engines, with observations on the advantages which it possesses over those in ordinary use. By URIAH BROWN, *Mechanical Draftsman, Washington City.**

TO THE EDITOR OF THE FRANKLIN JOURNAL.

SIR,—Should the subjoined description and investigation be thought worthy of publication in your journal, you will gratify me by insert-

* Mr. Brown has deposited his description in the Patent Office, for the purpose of obtaining a patent; this will account for the style of the communication.

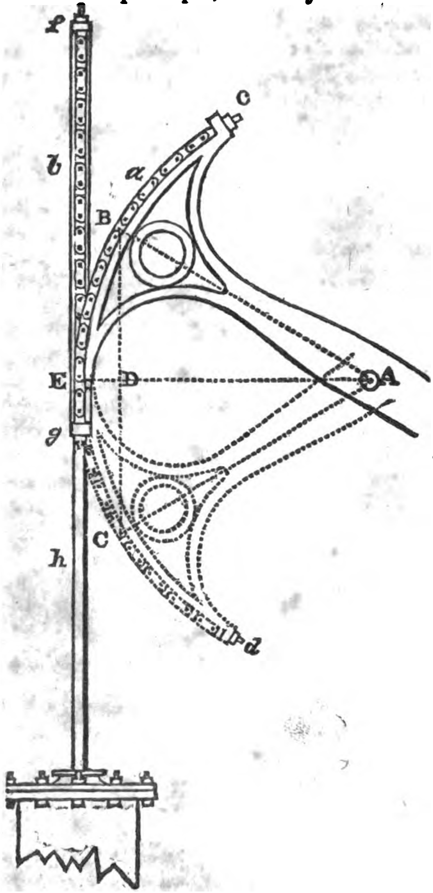
ing it. I believe that the plan is new, as I have examined several of the most esteemed publications on the subject of the steam engine, but have not seen described any parallel motion bearing a nearer resemblance to it, than the rack and segment, which, from its great friction, has been necessarily abandoned.

Yours, &c.

URIAH BROWN.

Washington, D. C., Sept. 10th, 1825.

The proposed improvement, I denominate "The Double Tangent Chain Lever;" the object of which, is to transmit motion and power from the piston to the lever or working beam of steam engines, and to convert the rectilinear motion of the piston, into a reciprocating circular, or a continuous circular motion, and, as I believe, upon a more simple, economical and efficient principle, than any which has been heretofore suggested.



This object, I propose to accomplish, by means of two chains, (*a* and *b*,) alternately working over the periphery of an arc at the extremity of the impelled end of the lever. The chains are formed similarly to the common watch-chain, and are each to be secured, by one end, to projections, (*d* and *c*,) at the extremity of the two opposite ends of the arc, by means of regulating screws and nuts; and by the other ends, to opposite vertical points, (above and below the arc,) of the cross bars, (*f* and *g*,) of an open parallelogram sliding frame; into the centre of which, directly over the piston-rod (*h*) with which it is connected, the periphery of the arc projects, and in which it oscillates freely. The chains lie parallel with each other and with the motion of the piston, from the two opposite points, where they are inserted into the cross-bars of the slide,

till they meet, or pass each other, at a tangent point (E) of the arc, horizontal to the fulcrum (A) of the lever; from this point, they follow the periphery of the arc to its opposite extremities (*c* and *d*,) and upon which they act as the agents of communicating motion and power from the piston to the lever, and the parts with which it is connected, by alternately elevating and depressing it; that is, by the upward stroke of the piston, the lever is moved from C to B, and by the downward stroke, it is returned again to C.

The advantages which I contemplate may be derived from this modification, are, the saving of that portion of the power of the engine, which is lost by the present methods of communicating motion to the lever, by the angle which the connecting rod makes with the piston-rod, and the lever, at the upper and lower points, (B and C,) and by the great degree of friction, which, consequently, unavoidably occurs, even in the most approved principle which has yet been adopted for preserving a parallel motion in the piston. This saving of power is effected, by reason of the chains working uniformly at a stationary tangential point (E) of the periphery of the arc; the *maximum* force of the engine being thereby constantly exerted at *radius*, and the chains rolling alternately on and off the arc, at the horizontal point (E,) maintain a perfectly uniform parallel motion in the piston, with no other friction than that which is occasioned by the slight working of the rivets in the connecting joints of the links.

In order to illustrate this proposition, and to show the decided superiority of the principle here suggested, over that of the lever in common use—in reference to the common lever, put radius A E= the length of the impelled end of the lever A B; and the sector through which the lever oscillates, from B to C, and *vice versa*=60°; that is, 30° above and below the radius, or horizontal line A D E. Now, as the piston-rod (*h*) moves in a tangent line to the radius A E, it is manifest that the motion communicating power to the lever, at any point, (A B) must be in a direction parallel to the tangent motion of the piston; therefore, at any point, (E) less than radius, the space through which the power moves, must be as the right sine of the angle of elevation or depression in the lever, and in that direction only; consequently, the efficient force which is exerted upon the lever in common use, at every increscent or decrescent point less than radius, is as the co-sine; and the power lost (or ineffectually exerted) as the versed-sine of the angle of elevation or depression.

$$\left.\begin{array}{l} \text{Putting } R = \text{the radius A E;} \\ v = \text{the versed sine D E,} \\ c = \text{the co-sine A D,} \end{array}\right\} \text{of the triangle A B D and A C D.}$$

M = the maximum power exerted at E = R;
l = the power lost = v; and
r = the residual power exerted = c,

it is, $M : l :: R : v$; and $M : r :: R : c$; or, transposing it,
$l : M :: v : R$ and $r : M :: c : R$.

Then, at an $\angle$ 30°, if R is = 1.
v is = .1339746, and
c is = .8660254.

Putting M = the power of 100 horses, it is,
$\overline{M=1} : \overline{l=.1339746} :: \overline{M=100} : \overline{l=13.3974600}$, the horse power lost, and $\overline{M=1} : \overline{r=.8660254} :: \overline{M=100} : \overline{r=86.6025400}$, the residual horse power applied. But, as this extent of versed sine, and its consequent proportionate diminution of power, is only of momentary duration, on the alternation of motion at the extreme zenith and nadir points (B and C,) the mean between these two points, and the horizontal point (E,) at which the *maximum* energy of the power is exerted, must be taken as the average loss of force sustained by the common lever—viz. equal to the versed sine of a fraction more than 21°,=6.6987300. Pursuing, then, the equation, and putting M = the mean loss of power at the versed sine of 21°, &c. we have,
$\overline{l=13.3974600}-\overline{M=6.6987300}=\overline{l=6.6987300}$, the average horse power lost; and
$\overline{r=86.6025400}+\overline{M=6.6987300}=\overline{r=93.3012700}$, the average horse power exerted. From which, it appears, that the average loss of power, on the common lever, ranging through a space of 60 degrees, is equal to 6.69, &c. per cent.; and the average power exerted, equal to 93.30, &c. per cent. of the maximum power of the engine.

To this loss may be added, that arising from the friction which occurs, in maintaining a parallel motion in the piston, particularly when the connecting rod is at its greatest angle with the piston rod, and the lever, at the upper and lower points (B and C;) at the very points, too, where friction is interposed to the greatest possible disadvantage of the engine; for, it is at the very instant, when the efficient power on the lever is at its *minimum*, and when the crank at the end of the antagonist lever is at its *dead point*, and when, consequently, there is no efficient power exerted upon it, except that which has been previously communicated to the fly-wheel, and by the *vis inertia*, alone, of which, the engine is relieved from the mechanical dilemma in which all these causes have conspired to place it. The power which is thus lost, by friction on the machinery necessary to maintain a parallel motion in the piston, and its injurious effect upon the crank motion, may, perhaps, be fairly assumed to equal the average loss of power on the lever, as before stated, viz. =6.6987300; which, added to 6.6987300, (the average loss on the lever) is=13.3974600, the whole amount of horse power lost; equal to 13.39 per cent. of the maximum power of 100 horses. Consequently, an engine, of the form in common use, computed to be equal to the power of 100 horses, is actually only equal to one of 86.60-100, &c. constructed upon the principles here proposed.

It may, perhaps, be urged as an objection to the proposed improvement, and as an argument in favour of the present form of steam engines, that it is unnecessary to work the piston through so great a range of stroke; or, if this should be requisite, a corresponding length of lever may be employed, which would lessen the angle of the connecting rod here mentioned. I am aware that this may, in some instances, be practicable; but I am equally aware, that just in proportion as the length of the stroke is reduced, will the recurrence

of passing the crank through the *dead points* of its circle be increased—a circumstance which ought carefully to be avoided, as far as practicable, by all engineers. A great length of lever is often attended with serious disadvantages; particularly in its application to steam-boats; where, for want of room and other circumstances, the lever, and, consequently, the length of the stroke, are circumscribed to small ranges; and the frequent return of the crank to the *dead points*, and the consequent *diminution* of power, is the result. But, admitting the length of the lever and the stroke to be indefinitely increased, the difficulties, before suggested, will, thereby, be only partially, but never entirely, overcome; whilst other equally serious ones, are produced by the ponderous weight and increased expense of the lever, and the parts with which it is connected.

It is obvious, from an inspection of the principle here proposed, that a great range of the piston is practicable, with a very small leverage, and that, consequently, the disadvantages incident to the common lever could be obviated by its adoption. Another consideration of no small practical importance in favour of the plan here proposed, is, its *simplicity*, and consequent less liability to get out of order, and the ease and facility with which the parts can be adjusted, if they become in any way deranged. A man with a wrench, can, in a few minutes, perform this operation, whereas, upon the present plan, it often requires the labour of a number of men, for several hours, to adjust, properly, all the nice and intricate parts, connecting the lever with the parallel motion of the piston.

This principle is intended to apply equally to the connexion of the lever with all the pistons, appertaining to a steam engine; and to all other machines, where a rectilinear motion is to be converted into a reciprocating circular, or a continued circular motion.

I do not pretend to be the inventer of the chain, nor the first to have suggested the application of it *singly*, to the working of the Steam-Engine. Messrs. Savary, Brighton, Watt, and others, having, many years since, applied a *single* chain to their atmospheric and single-acting engines, where a rectilinear motion was only required, and the use of which was, no doubt, discontinued by them, from their not having perceived the extended application of the principle to produce a rotary motion, at the time that steam engines began to be employed as a power for general manufacturing purposes. Nor do I claim to be the discoverer of the adaptation of chains to machines where a reciprocating rotary motion is to be converted into a reciprocating rectilinear motion; chains having been already employed for this purpose, in the construction of fire-engines, &c. What I claim as my invention or discovery, is the adaptation of *two* chains, as before described, to effect a reciprocating, or a continued circular motion, in steam-engines, and in other machines. U. B.

LIST OF ENGLISH PATENTS.

List of Patents for New Inventions, which passed the Great Seal, from April 26th, to June 3d, 1828.

To William Marshall, shear manufacturer, for his invention of improvements in machinery for cutting or shearing, cropping and finishing cloth and other articles, manufactured from wool or other raw materials—April 26.

To Thomas Briedenback, merchant, for his invention of a machine, or improved mode by use of machinery, for forming or manufacturing tubes or rods, and for other purposes—April 26.

To James Griffen, scythe manufacturer, for his invention of an improvement in the manufacturing of scythe backs, chaff knife backs, and hay knife backs—April 26.

To John James Watt, surgeon, for his discovery, by the application of a certain chemical agent, by which animal poison may be destroyed and the disease consequent thereon effectually prevented. April 29.

To Charles Carpenter Bombas, Esq. for his invention of improvements, in the propelling of locomotive carriages, and machines, and boats, and other vessels—April 29.

To Thomas Millman, mast maker, for his invention of certain improvements in the construction and fastening of made masts—May 1.

To Jonathan Brownill, cutler, for his invention of an improved method of transferring vessels from a higher to a lower level, or from a lower to a higher level on canals; and also, for the more conveniently raising or lowering of weights, carriages, or goods, on rail roads, and for other purposes—May 1.

To James Palmer, paper-maker, for his invention of certain improvements in the moulds, machinery, or apparatus for making paper —May 6.

To Thomas Adams, manufacturer, for his invention of certain improvements on instruments, trusses, or apparatus for the relief, or cure of hernia or rupture—May 6.

To Francis Westley, cutler, for his invention of certain improved apparatus to be used for the purpose of whetting, or sharpening the edges of the blades of knives or other cutting instruments—May 6.

To Samuel Brooking, Esq. a rear-admiral in our royal navy, for his having invented a certain turning or shipping fid for securing and releasing the upper masts of ships and vessels—May 6.

To Matthew Fullwood, junior, gentleman, for his invention of cement mastich or composition, which he intends to denominate German cement—May 6.

To John Benjamin Macneil, engineer, for his invention of certain improvements in preparing and applying materials for the making, constructing, or rendering more durable, roads and other ways, which materials so prepared are applicable to other purposes—May 6.

To Thomas Jackson, watch-maker, for his invention of a new

metal stud, to be applied to boots, shoes, and other like articles of manufacture—May 13.

To John Ford, machine-maker, for his invention of certain improvements in machinery for clearing, opening, scribbling, combing, slubbing, and spinning wool, and for carding, roving, or slivering and spinning cotton, short stapled flax, hemp, and silk, either separately or combined; and for spinning or twisting long stapled flax, hemp, silk, mohair, or other fibrous substances, and either separately or combined—May 13.

To Thomas Bonsar Crompton, paper-maker, and Enoch Taylor, millwright, for their invention of certain improvements in that part of the process of paper-making, which relates to the cutting—May 13.

To Charles Chubb, patent lock manufacturer, for his invention of certain improvements in the construction of latches, which may be used for fastening doors and gates—May 17.

To Thomas William and John Powell, glass merchants and stoneware manufacturers, for their invention of certain improvements in the process, machinery, or apparatus, for forming, making, or producing moulds or vessels for refining sugar; and in the application of materials hitherto unused in making the said moulds—May 17.

To Thomas Aspenwall, Esq. in consequence of a communication made to him by a certain foreigner residing abroad, for an improved method of casting printing types, by means of a mechanical process, which invention he proposes to call the mechanical type caster—May 22.

To Samuel Hall, cotton manufacturer, for his having invented or found out a new method of, and an apparatus for, generating steam and various gasses, to produce motive power, and for other useful purposes—May 31.

To James Moffat, master-mariner, for his having invented an improvement in apparatus for stopping and securing chain cables, also for weighing anchors attached to such chain or other cables, either with or without a messenger—June 3.

To Daniel Jobbins, millman, for his having invented an improved method, by certain machinery applicable to stocks or fulling machines, for milling and scouring woollen cloths and other fabrics requiring such process—June 3.

LIST OF FRENCH PATENTS

Granted in the third quarter of the year 1827.

(Concluded from p. 216.)

To Courtois, Jacques Antoine, builder, for improvements in making tiles, and the manner of fixing them—15 years.

To Mrs. Widow Susse, of the family of Aglae, Reine, Aube, engraver, Paris, for a method of engraving and marking all kinds of drawings, &c. upon skins and leather—10 years.

To Dupon, Jean Pierre, merchant, Paris, for an apparatus for heating and lighting houses by means of hydrogen gas, called the *Chimenee gazofumivore*—15 years.

To Noziet, Louis, clock and watch maker, Tours, for a machine by which the pendulum of clocks can adjust itself—5 years.

To Duport Union, merchant, Paris, for jointed clogs—5 years.

To M. Pierrou, architect, Paris, for an autographic press—5 years.

To Ratcliffe, Thomas, iron founder, Paris, for a mechanical needle for spinning and twisting wool, silk, cotton, hemp, and flax—5 years.

To Godain, Jean Marie Theodore, hair dresser and perfumer, Paris, for a lotion called the *Creme des Lybarites*, for dying the hair —5 years.

To Luzier, Jean Jacques, gunsmith, Paris, for a method of producing two discharges from one barrel, either by percussion or flint—10 years.

To Picqueuer, Onesiphon, mechanic, Paris, for a new system of towing vessels—10 years.

To Messrs. Blanc and Conville, Paris, for improvements in the use of steam engines in drawing off or raising water—15 years.

To Poupart, Abraham, manufacturer, Sedan, for the invention of cylinders, with metallic blades, for cleaning, carding, and combing wool, &c. and instead of thistles, in the napping of cloth—15 years.

To Messrs. Thebes, uncle and nephew, merchants, Forbes, for a method of bruising all sorts of oily grain—15 years.

To Messrs. Provost and Co., Paris, for a mode of giving constant publicity to all acts, advertisements, &c.—5 years.

To Egg, Joseph, merchant, for a self-priming percussion gun—10 years.

To Egger, upholsterer, Paris, for improvements in making moveable tents—5 years.

To Morize, Jean Baptiste, cutler, Paris, for a pair of shears, with machinery for regulating the length to be cut, called *cisoir de proportion*—5 years.

To De la Roche, stove manufacturer, Paris, for an apparatus to be used instead of dogs in chimneys, and to supply the place of vent holes—5 years.

To Curreau, Noel Andre, Paris, for a mill for grating or grinding salts—5 years.

To Veret, Joseph Brionne, Eure, for a machine for stretching wool—5 years.

To Brouillet, Louis Francois, Paris, for a distilling apparatus—5 years.

To Lantieres, Pierre, silk weaver, Lyons, for a machine for making the warp of silk—10 years.

To Messrs. le Comte, Reil, and Pichon, Paris, for a rotative machine, moved by steam—10 years.

To Godart, Jean Baptiste, Amiens, for a machine for peeling hemp and flax, with or without previous steeping—15 years.

To Messrs. Nezy Viry, and De Cormeille, Paris, for an apparatus called the *fumi comburateur*, for consuming smoke and all its hurtful particles—10 years.

To Vaughan, George, engineer, Paris, for improvements in steam-

engines, whereby the forçe is augmented, and the expense diminished—10 years.

To Joanne Brothers; Mouzin, Philibert; and Lecomte, Eugene, Dijon, for a machine for causing boats to sail up a current by the impulse of the water only, and which may be applied to land carriages by means of using steam—15 years.

To Muller, Charles Francois, Paris, painter, for a mechanical desk —5 years.

To Willer, Jean Charles Guillaume, surgeon, Paris, for a lotion, called *Eau d'Hebe*, for removing freckles—5 years.

To Poisson, Louis Pierre, Paris, for a process of making paper and pasteboard, of liquorice root—5 years.

To Garat, Joseph Dominique Febry, Paris, for an extra clog or shoe, called a *paracrotte*, for guarding the feet and legs from damp and dirt—5 years.

To Caire, Jean Alexis, Paris, for a machine with a swivel, for corking bottles—10 years.

To Marquis de Saint Croix Molay, Pierre Hyppolite de la Poterre, Paris, for the invention of moveable metallic arches, or metallic portable siloes—15 years.

To Messrs. Brian and De St. Leger, Paris, for a process for making hydraulic artificial lime—15 years.

To Dalton, Samuel, Paris, for a method of making silk, cloth, and other buttons, without seams, by machinery—5 years.

To Causon, Brothers, paper makers, of Armonay, for a method of sizing paper—15 years.

To Beaudouin, Jean Baptiste, Paris, for a sub-marine navigation —15 years.

To Houzeau, Nicolas, Paris, for a method of lighting by portable gas—5 years.

To Harmey, Joseph, Paris, for a method of using carding machines by hydrostatics—5 years.

To Lavand, Antoine, writing master, Perigueux, Dordogne, for a method of teaching four kinds of writing in twenty lessons, and ten in sixty lessons. This valuable system is called the *Calligraphie Francoise*—5 years.

To Durant, Nicholas Felix, Chalons-sur-Marne, for a new invented coffee pot—5 years.

To Tregnet, Vincent Pluvoise, piano-forte maker, Paris, for a piano with isolated sounding board—10 years.

To Joannis, secretary to the board of health, Paris, for a method of purifying metals, minerals, cast iron, and metals in general, used in casting—15 years.

To Proust, Alexis, Rochelle, Charente, for a distillery and apparatus—5 years.

To Revillon, Thomas, clock and watchmaker, Macon, Soane and Loire, for sundry improvements in striking the hours of public and private clocks—10 years.

Erratum.—In p. 202, (last number) line 15 from the top; for *or sound*, read *on sound*.

Fig.5.

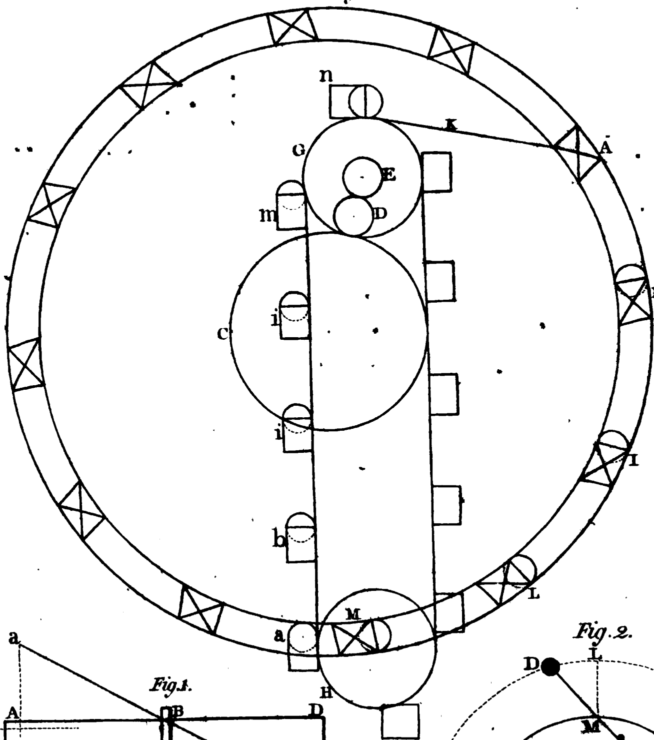


Fig.1.

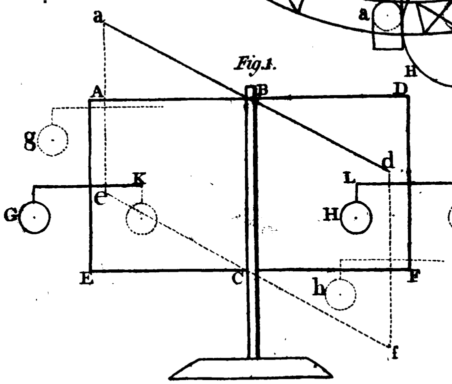


Fig.2.

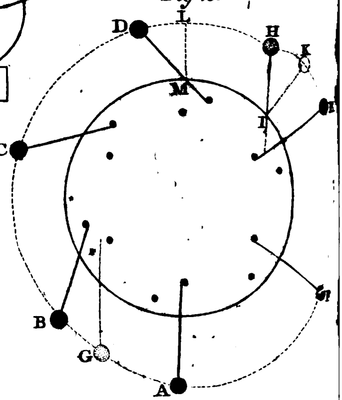


Fig.4.

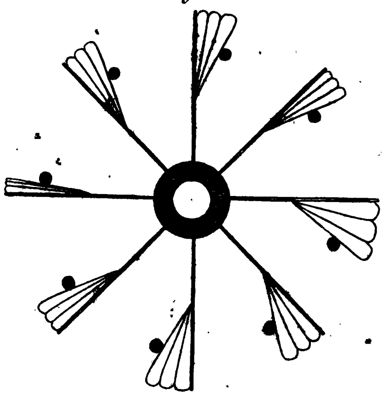
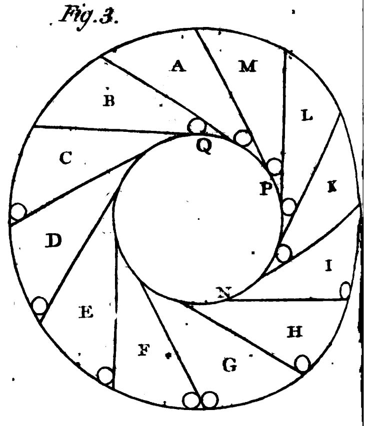


Fig.3.



THE

FRANKLIN JOURNAL,

AND

AMERICAN MECHANICS' MAGAZINE;

DEVOTED TO THE

USEFUL ARTS, INTERNAL IMPROVEMENTS, GENERAL SCIENCE,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

NOVEMBER, 1828.

An Essay on Calico Printing.

[Extracted from Parke's Chemical Essays.]

[CONTINUED FROM PAGE 228.]

In reverting to the remaining processes of the print-work, it must be noticed, that when the goods have passed through the weld or madder copper, they are usually carried to a boiler containing wheat-bran and water, in which they are winched for a considerable time, for the purpose of freeing the white grounds from the stain which they had acquired from the madder or the weld. This process always impairs, in some measure, the intensity of the colours; but it is a necessary operation, as there is no other mode so convenient for removing the stain which is always given to the white part of the print by the madder, the bark, or the weld, which has been used in dying it.

Branning has also the effect of giving a pink hue to all madder reds. But it is not generally known what a peculiar richness may be imparted to madder colours, by raising them with a mixture of bran and madder; that is, by mixing a portion of bran with the madder in the first instance. I have myself sometimes produced colours in this way, whose brilliancy has astonished me.

This mode of dying red with a mixture of bran and madder, is called, in the trade, *Growse's*, or London pink, and was invented by a journeyman calico-printer, near London, of the name of Growse, who sold the recipe for 100 guineas. In this process, the acid of the bran prevents the precipitation of the *fawn-coloured* particles of the madder, and the red produced is, consequently, more rosy and pure.

Madder contains two distinct species of colouring particles, a beautiful red or rose colour, and a degraded yellow or fawn colour —both are precipitated on the cloth, in the usual dying process, to the great injury of the *tint* obtained. The object of the tedious Turkey-red process, is to fix the red colouring particles so firmly as to allow the fawn-coloured ones to be dissolved and discharged by long boiling in solution of soap or soda, by oxymuriate of soda, or by acid solutions of tin. A dilute supersulphate of potash has lately been used with success for this purpose, in France.*

It frequently is the case, however, that goods will not bear to be sufficiently branned to clear the whites entirely by that one operation;† such goods, therefore, are partially cleansed in the branning-copper, and are then laid on the grass for some days, until they become perfectly clean and white.

But, within the last few years, a new method has been introduced, which consists in immersing the pieces for a certain time in a very weak solution of one of the bleaching salts, such as oxymuriate of potash, soda, or magnesia. This simple process, which effects, in a few minutes, what would require more than as many days in grass-bleaching, is now much practised, and promises, very soon, to supersede crofting entirely. This is a most important improvement, as some of the large printers formerly required as much land to spread out their goods upon, as would make a farm of a very considerable size.

Besides the kinds of calico-printing already mentioned, there are others which it will be proper to notice in this place. Of these, what is called resist-work, is now done in considerable quantities. It is conducted in the following manner.

A certain preparation of copper, mixed either with flour paste, with gum, or with pipe-clay and gum, is printed on the calico, in any shape or of any pattern that may be desired.‡ When this is sufficiently dry, the goods are repeatedly dipped in the blue vat till they have acquired that depth of tint which may be required. The art of making an indigo-vat, or blue-vat, as it is sometimes called, consists in forming such a mixture of lime and sulphate of iron as shall most effectually deoxidize the indigo; as indigo has no affinity for cloth in its natural or oxygenized state. Hence those parts of a piece which are printed with the solution of copper, will never be dyed blue in one of these vats; because the deoxidized indigo becomes oxygenated the moment it touches the copper, which parts

* See "A Collection of Observations on Madder," by Berthollet, *Annales de Chimie*, tom iv. page 102. M. Watt "On the Properties of Zealand Madder." *Ibid.* page 104. Vogler "On dying Cotton with Madder." *Ibid.* page 109.

† The temperature at which the operation of branning is performed, is very important. If bark yellows are dyed at 100°, it is customary to bran such goods at 115° or 120°, as it is a principle always to bran at a higher temperature than the goods are dyed at. Madder-work must be branned at a boiling heat.

‡ The sulphate, the nitrate, the muriate, and the acetate of copper, have all been employed for preparing the resist-paste; but I believe the sulphate is the best for the purpose, unless a very concentrated solution of the four salts were prepared by successively dissolving each of them in pure water..

with its oxygen to the indigo, and occasions it to become insoluble, and, consequently, incapable of forming a dye.

Thus, while sulphate of iron has the power of deoxidizing indigo, sulphate of copper, or any other salt of that metal, is incapable of retaining its oxygen, whenever it comes in contact with that singular substance in a state of deoxidizement; and it is a curious instance of the different degree of intensity by which oxygen is held by the different metals.

I suspect, however, there is often great waste in the management of these vats, and that the contents are often thrown away long before the indigo is spent, in consequence of the want of a due admixture of the lime and the sulphate of iron with the colouring matter; whereas, if a dyer or calico-printer be acquainted with chemical science, he will understand the nature of the operation of these substances upon each other, and hence can be at no loss how to keep up the vat to its original strength, by replenishing it, occasionally, with one or other of the ingredients, as may be required.

The fact is, that indigo, unless it be deoxidized, is insoluble either in the alkalies or the alkaline earths; but when this is effected by the iron of the copperas, the lime dissolves it, and forms it into a perfect solution of indigo. At first, a portion of the lime abstracts the sulphuric acid from the copperas, and precipitates with it in the state of sulphate of lime. The detached metal being now in the state of the protoxide of iron, and having in that stage of its oxidizement a great affinity for oxygen, it takes it from the indigo, and thus becomes changed to the peroxide of iron, which, being insoluble, precipitates likewise. Thus the acid, and the base of the sulphate of iron, are, at length, both precipitated, when the remaining portion of lime seizes the deoxidized indigo, and forms with it the solution desired. When the principle of the blue-vat is thus properly understood, it is an easy thing for the manager, at any time, to discover which of the three materials is deficient, and to add it accordingly. I am the more desirous of offering these remarks, because I have many times heard the proprietors of a manufactory declare, that they have, occasionally, thrown away the whole contents of a new vat, containing many pounds worth of indigo, because the foreman or managers of the works had not observed the due proportions of the lime and the copperas, to put the indigo into a proper state for working; and they have an idea, if it is once wrong, it must be always so, and, therefore, they throw it away, without attempting to correct the error.

To revert to the process of resist-work, it is necessary to say, that when the pieces have been sufficiently immersed in the blue-vat, and have been washed and passed through diluted sulphuric acid, those parts which had been printed with the preparation of copper, are found to be preserved a good white; the preparation having effectually resisted the operation of the indigo, though all the other parts of the cloth have received a permanent dye. The various deep blue calicoes with white spots or white figures, which are now so common, are, generally, done in this way; and, by a similar management with

subsequent dying in madder, in weld, or quercitron bark, figures in red or yellow (as the case may be) are exhibited upon a blue ground.

In some particular styles of work, the operation of certain colours is resisted by means of stopping out with wax; but this is too expensive a method to be adopted often, in these times, when it is the object of every manufacturer to finish his prints at the least possible expense. Formerly, this mode was very generally practised, and wax was consumed in very large quantities by this process.*

In printing those silk handkerchiefs, called Bandanas, a process called waxing is still followed. It consists in making a preparation of tallow and rosin, very liquid by heat, and in printing it in that state, with a block, upon the silk. When such goods are passed through the blue-vat, those parts which are covered with the tallow and rosin, are preserved from the action of the indigo, and remain white, while all the rest is dyed a fast blue. The method afterwards taken to discharge a part of this blue, and produce yellow, orange, &c. will be mentioned hereafter.

A very singular looking substance was discovered a few years ago near Stockport, which, being handed about from one to another, created considerable interest in that neighbourhood. Every body supposing it to be a natural production, specimens of it were sent to a variety of persons in various parts of the kingdom, for their opinion and analysis, and among others a portion was sent to myself. However, after every one had been busily engaged in examination and conjecture, respecting this unknown substance, it was announced, that some seventy or eighty years before, a calico-work had stood on the spot where the article was found, and that this was nothing more than a large heap of the refuse compound of flour, wax, and gum, above-mentioned.

The reader will perceive that these *resists* are employed for the purpose of preserving certain parts of a piece white, and of giving other varieties to those goods in which blue is the predominant colour; but if the ground is to be white, and the piece is only to have one small object† in indigo blue, such as a single sprig, then a different management is necessary, and the colour is imparted by a process which is called *pencil-blue*.

Here the indigo is deoxidized by means of orpiment, which is a sulphuret of arsenic; and, formerly, whatever objects were done with it were put in by means of a pencil: hence its name, PENCIL-BLUE.

Pencil-blue is composed of the following ingredients, viz. Ten ounces of indigo finely ground in water; twenty ounces of quick-lime in lumps; the same quantity of potash of commerce, or the impure sub-carbonate of this alkali; and ten ounces of orpiment. These proportions require one gallon of water, and when the whole has been properly mixed, and time has been allowed for the sediment to subside, the clear colour is to be carefully poured off and thickened with gum senegal.

* In the East Indies, wax is still used for preserving the whites in calico-printing.

† *Object* is a technical term belonging to this branch of manufacture.

The intention in using this preparation, had always been to impart it to the calico, before the indigo had time to recover its oxygen: hence, a small quantity only was mixed at once, or no more than could be pencilled on in a very short time; but the inconvenience which attended this plan, gave rise, at length, to an invention which has nearly superseded the use of the pencil.

The invention to which I refer, is the spring-sieve, which may be thus described: A fine canvass sieve is suspended within a tub of pencil-blue colour, so contrived, that the canvass should be in contact with the colour, and follow it as it is wasted. But as the colour was consumed, the sieve did not always exactly sink with it, which occasioned great uncertainty, and, sometimes, considerable disappointment, from the admission of too much atmospheric air:—to obviate these inconveniences, many schemes were resorted to, but none of them completely answered the purpose.

This utensil has, however, now been much improved by a particular friend of mine. The improvement consists, essentially, in the addition of a vessel upon the principle of the common bird fountain, which is filled with the prepared indigo, and closely corked. This supplies the blue-tub just as fast as it is exhausted.

Another kind of process remains to be noticed, called CHEMICAL-DISCHARGE work. Here the cloth is first dyed of some uniform colour, by means of a mixture of iron-liquor, and some one or more of the common vegetable dying substances; and calicoes thus prepared are said to be dyed of self-colours. They are then washed and dried; and when properly pressed or calendered, they are fit for receiving any pattern whatever, according to the taste or design of the artist.

This is generally effected by means of the mineral acids, which are previously prepared for the purpose, by dissolving in them a portion of one or more of the metals, according to the nature of the dye which is intended to be discharged, or of the colour to be produced. In doing this, care is taken that the discharging liquor be made so as to be capable of dissolving the iron which is contained in the dye, and which is always used in such quantity as to cover, or at least to disguise, in a great measure, the other colour or colours, which had been employed with it, and, at the same time, to act as a mordant, in beautifying and fixing those colours.

Thus a piece treated with a decoction of Brazil-wood, and dyed black by being padded* with iron-liquor, if, when dried, it be printed with a peculiar solution of tin, the ferruginous portion of the dye will be dissolved, and the printed part will instantly be converted from a deep black to a brilliant crimson.

In the same way, an olive-coloured calico, dyed in a solution of iron and a decoction of weld, will as quickly be changed to a pale bright yellow; and the various drabs and slates of every shade which

* By the term *padding*, is understood, the operation of passing the pieces from a roller through a trough containing a solution of iron, or any other mordant. *Blotching* is another term used in calico-printing, and is synonymous with padding.

have iron in their composition, will undergo as sudden a change, by the same treatment; though the colour of the figures produced on them will depend on the materials with which the cloths were originally dyed. Even the deepest gold colours, or strongest buffs, if produced by iron only, may, by a peculiar preparation of tin, be discharged; and such parts of the cloth as have been treated with this metallic solution, will be restored to their pristine whiteness.

By similar management, calicoes dyed of a light blue in the indigo-vat, then run through sumach and copperas, and finished in a bath of quercitron bark and alum, may have figures of a bright green imparted to them. Here the green is originally formed by means of the indigo-vat and the bark, though it is enveloped by the iron of the copperas, which overcomes the other colours, till the solution of tin is applied, which removes the iron from those particular parts, and gives a brilliancy to the remaining colours which they would not otherwise have possessed; the tin being a powerful mordant for the bark, by which the yellow of the green is produced.

Again, a good self-colour may be given to calicoes, merely by dying them in sumach and copperas, and then running them through an alkaline solution of annotto; and here the figures produced by the application of a colourless solution of tin, will be of a bright orange. But, it is needless to enumerate more instances, as the workman accustomed to a dye-house, will have little difficulty in varying these in a thousand ways, when he becomes acquainted with the nature of the solution of tin which he employs.

The whole of this, however, refers to that branch of discharge-work, only, where all the purposes are attained by dissolving the iron which makes a part of the colour that is intended to be discharged; whereas, the finer and more expensive work, is done in a different way, and by a process which it will be necessary for me, presently, to describe.

It is, however, proper to remark, that there is an objection to the particular kind of chemical discharge-work, of which I have been speaking, namely, that it is not perfectly fast; that is, the goods produced in this way, will not bear such frequent washing, as those which are done by the bath of madder or bark.

It is certainly an object of great national importance, to give a permanency and beauty to the calico-printing of the country;* and a great deal of very excellent printing is now done in various parts of the kingdom, especially for the best chintz-work and other furniture patterns. But, in what is called fast-work, there is a great variety of qualities, and some of it little deserves the name of permanent.

The mention of permanent colours, reminds me of a very valuable GREEN, which was invented some years ago, by a Mr. Islet of

* To this end, great improvements have, of late years, been made in the method of grinding madder-roots, by separating the inferior parts, and dividing the whole into two or three different qualities. Thus the printer is enabled to apply the finest, which, in this way, is made equal to Dutch crop-madder, to his best work, and the other can be laid by for inferior purposes.

London, and which deserves to be noticed in this essay. This colour, which was secured to him by his majesty's letters patent, is produced by printing ground indigo mixed with a peculiar kind of solution of tin, and in then fastening the indigo within the fibres of the calico, by means of that process, which is well known to printers by the technical designation of *china-blue dipping.** After this, the goods are dyed in a copper of bark or weld, which converts the blue to a green, and the whites are afterwards cleansed by croft-bleaching, &c.

Having myself formed a very high opinion of this invention, I had several interviews with Mr. Islet, soon after he obtained the patent, and from him was fully informed of the whole process. This I have since repeated, for the purpose of verifying the detail in all its branches; and I am satisfied, that it is one of the most beautiful and PERMANENT colours that has ever been fixed upon cotton.

There is another mode of producing very beautiful blues, which has been much practised lately, and, therefore, deserves notice. This consists in printing some solution of iron, and then passing the goods through a very dilute and neutral solution of prussiate of potash. The Prussian blue which is thus formed upon the cloth, may be rendered tolerably permanent by a variety of expedients, and this, by means of any of the yellow dyes, may, afterwards, be formed to any shade of green or of olive.

[TO BE CONTINUED.]

Sketches of the Progress of Inventions, connected with Navigable Canals. Compiled from various sources.

[FROM THE BOSTON JOURNAL OF SCIENCE.]

[Continued from p. 233.]

THE following is a description of a new mode of building locks, invented by J. L. Sullivan, Esq., which he denominates the *Composite Lock.* Communicated by the inventor.

The object of the Composite Lock is, to use wood, as the cheapest material, and yet so that it shall be *durable.* This is effected by excluding from the substance of the structure, the *causes* of decay, *air* and *water.* The means of doing it, are found in the following mechanical and chemical principles, using as materials, thin boards, sheathing-paper, pitch, and lime.

The manner of building, affords the greatest strength, because the fibres of the wood cross each other in alternate layers, transverse and lengthwise; trenailed very firmly, as they are successively put together; and with intermediate tarred paper; each succeeding sur-

* China-blue is produced thus:—Indigo, ground fine, and then thickened, is printed upon the cloth, and afterwards it is dissolved, and chemically united to the fabric, by alternate immersion in a solution of sulphate of iron and in lime-water.

face being payed with pitch, after the seams are caulked. This separation of every piece of wood, from every other, prevents fermentation and rot between them; and, if the work is well done, the structure must be impervious to water and air. Then, as carbonaceous substances are of an imperishable nature, this wooden fabric, by being penetrated and filled with tar, must, by its efficacy, remain sound, as long as this substance retains that property.

The use of a small proportion of lime, among the pitch, is to form a *cement*, and neutralize any acid that may be in the wood.

This method has some analogy to the well known use of the pyroligneous acid, in preserving provisions, now beginning to be applied to the timber in ships. Its efficacy is attributable to the antiseptic properties of the components of smoke (vinegar and carbon.) Smoke differs from tar, principally, in being *volatile*, instead of being concentrated. But pitch, which is a more concentrated tar, is better for this purpose; because, besides penetrating the pores of the wood, it forms a defence of its surface. One of the late improvements in the British navy, (by Mr. Seppings) among others, is to inject a ship's frame, or to fill the pores of the wood with tar.

The manner of building a *composite lock chamber*, is simply this: the pit being dug, rough walls will, of course, be necessary to sustain the ground: these will also sustain the lock laterally, and its upper end.

After bolting a cap-piece on the walls, having an under groove overhanging the space a few inches, and after flooring the space between the walls with a mass of small stones for the bottom of the chamber to rest on, the work is begun by lining the space, first with thin oak boards, (as bending more easily) which reach from the under groove of the cap on one side, down the wall, across the bottom, and up the opposite wall to the groove on the other side, nailed to each cap. The seams being caulked with oakum, and the whole surface payed, it is then covered with tarred paper. It is now ready to receive the first *lengthwise* layer of pine, to be trenailed or nailed through the paper to the first layer. This second course is next to be caulked, and payed, and papered, to receive the *second transverse* layer of oak, which is covered and completed in like manner; and the fourth course, or second lengthwise (if the last) is finished by caulking and graving. The *trenails* of the successive lamina all reach to the first layer. They are made by machinery, and compressed, that they may expand and cohere more firmly after being driven.

But if the lock is of uncommon depth, which this method of building permits, one or two courses more may be expedient. Two locks of this kind may be made to lift as many feet perpendicularly, as *three* locks on the old and usual plan: thus saving one-third of the locks of a canal.

The outside surface only, is exposed to the air; but as it is in contact with stone, which keeps it cool, it will remain sound. The inside surface will be protected sufficiently, by a renewal of its coat of pitch from time to time. The bottom, being always under water, will remain sound. The gate-posts may be either of wood, stone, or

cast iron. Instead of culverts, horizontal pivot gates are used (as on Middlesex canal;) placed above the upper pair of lock gates, which let the filling water descend into the lock chamber, through the upper floor; the lower floor being protected from wearing, by means of timbers, plank, or stone.

The saving, in the first cost of this kind of lock, compared with cemented walls, is such, that were the difference put at *interest* for the period of its duration, it would amount to many times more than the expense of replacing the chamber, eventually. It is, therefore, true economy. This manner of building, is also well adapted to our country and climate; as the material abounds, and the frost sometimes heaves the walls of locks, and destroys the cohesion of their cement: in England and France, the winters are too mild for this effect.

Thus great durability is given to a wooden structure, and lockage in river works made more practicable, and less costly. In this way may be also constructed the *aqueducts* of a canal.

J. L. Sullivan.

Mr. Sullivan has also furnished a description of a machine, invented by Mr. Dearborn, of this city, as a substitute for the lock. This machine, although it bears a strong resemblance to some of the inventions described in our last, under the name of balance locks, is yet, we should think, more practicable than any of them. A single vessel, which Mr. Dearborn calls a *transit*, is suspended by chains, running over pullies, and counterbalanced by weights. In this, the canal boat is moved vertically, from one level to the other, and such provisions are made, that no change of the levels, from floods or drought, can derange the operations.

Having noticed the principal inventions for uniting different levels or sections of canals, we shall proceed with an account of some of the striking improvements in the architecture of these works. Amongst these, none are more imposing than the tunnels and aqueducts. The first tunnel constructed for the purpose of navigation, was on the Languedoc canal. This was considered the wonder of its time. It was cut through the ridge of Malpas, near the town of Beziers; its length is 720 feet, and, for the most part of the way, it is lined with stone. The expense of this work has been stated at 13,000,000 livres. An enormous sum, considering the value of money, and the resources of France at that period (1670).

The tunnels connected with Bridgewater's canal, were the first works of the kind undertaken in England, and they continue unrivalled in extent and importance. These tunnels are said to be, in all, more than 18 miles in length; many of them hewn out of the solid rock, and sufficiently large for the passage of boats 4½ feet wide. From a branch which passes under Manchester, coals are taken up, for the supply of that town, by simple machinery, constructed by Brindley.*

* James Brindley, the engineer under whose direction Bridgewater canal was constructed, and whose name is so intimately connected with canal improve-

Tunnelling can only be accomplished by tedious digging and blasting; it necessarily goes on slowly, as no more room can be obtained for the labourers, than they burrow for themselves.

Aqueducts for continuing canals over vallies and rivers, are constructed on principles similar to those which guide the construction of bridges. They differ little from the common bridge, except in having, in the place of a road, a water-tight channel, through which the canal water and boats pass. Aqueducts, equally with bridges, may be made an ornament to the country, by a proper architectural arrangement. It is not our purpose, however, to consider them in the light of ornamental structures, but simply as works for continuing the levels of canals. In this view, the material of which they are constructed is of great importance. In Europe, until within a few years, stone was the only substance considered proper for these works; and the ancient aqueducts, for supplying cities with water, attest forcibly to the durability of this material. Wood, which has been so freely used in all works in this country, has, up to the present time, been the principal article in our aqueducts. But its certain and speedy decay, has shown how utterly unfit it is for

ments, possessed so rare a genius, and was of so singular a character, that we cannot forbear giving some account of him. He was born in Derbyshire, in 1716, and his father, having wasted his small property in field sports, young Brindley was obliged to labour, almost from his infancy. At the age of seventeen, he bound himself apprentice to Mr. Bennett, a millwright, near Macclesfield. Here, the superiority of his genius unfolded itself, and long before the expiration of his apprenticeship, the millers placed more confidence in his opinions than in those of his master, and such was his devotion to his business, that for the purpose of obtaining correct information about some parts of a paper-mill, he took pains to visit a mill, at the distance of fifty miles, between Saturday evening and Monday morning; this being the only time he could spare from his work. After the expiration of his apprenticeship, he was employed on various works, and his reputation was constantly increasing in his little circle, until he attained the age of forty. It was at this period of his life, that the duke of Bridgewater required his assistance for his projected canal. Here his genius found its proper field, in planning and executing that great work. He, however, accomplished all the parts of his undertaking, in a manner, not only satisfactory to the duke of Bridgewater, but with such display of talent, that succeeding engineers have constantly referred to his works as models for imitation. The strength of his genius is made the more apparent, when it is considered, that his profession, more than most others, requires mathematical learning, and that he was so wholly illiterate, that it is yet in some degree disputed, whether he could even read or write. When any great effort of his mind was required, it was his custom to retire to bed, where he remained until his task of invention was accomplished, which sometimes lasted two or three days; when he would get up and put his design at once into execution. He kept his attention so unrelaxingly fixed to the subject of his profession, that having been prevailed upon once, when in London, to go to a play, he declared afterwards, that he would never repeat the experiment, as the spectacle produced such a distraction of his thoughts, as to unfit his mind for its proper actions. An answer of his, to a committee of the house of commons, shows strongly his singleness of purpose. Having, at an examination of some points relating to canals, spoken lightly of the use of rivers for navigation, he was asked, what he thought rivers were made for? after a moment's hesitation he replied; "to feed canals with." Mr. Brindley died at the age of fifty-six years.

this purpose. The aqueducts on the Middlesex canal, although built but about twenty years since, have not only required large repairs, but, we believe, one of the most expensive of them has required to be rebuilt.

We are happy to see that a sounder judgment or richer means, has directed the execution of these works on the great western canal, and we may instance the aqueduct which conveys that canal over the Genesee river, as worthy of imitation in other rising works. This aqueduct, as appears from an account by Mr. Bates, engineer for the section of the canal in which it is situated; is about 800 feet long, crossing the river with 11 arches, most of which are of 50 feet chord. The piers are of no very magnificent height, but are substantially built. The whole fabric is of hewn stone, and sufficiently massive to give it durability. It was built with the rapidity which characterizes our countrymen in all their undertakings: it having been completed in little more than one year from its commencement.

A very important improvement was made, in England, a few years since, in constructing aqueducts. We shall give the history of this invention from the excellent article, *Navigation Inland*, in the Edinburgh Encyclopædia.

"But about the year 1795, Thomas Telford, having been entrusted with the management of the Shrewsbury and Ellesmere Canals, had his attention drawn to the construction of some large aqueducts, and having observed, in some instances, the masonry of aqueducts where puddle was employed, to be cracked, and very subject to leakage, and some parts not unfrequently obliged to be taken down and rebuilt, or tied across by strong iron bars; these circumstances led him to consider of introducing cast-iron work. This he did, in the first instance, upon the Ellesmere Canal at Chirk, where the aqueduct was 600 feet long, and 65 feet high above the river; here he rejected puddle, built the spandrels over the arches with longitudinal walls only; across these walls, cast-iron flaunched plates were laid, as a bottom to the canal, and also on purpose to bind the walls horizontally; these were well jointed, screwed, and caulked; the sides of the water channel were built with stone facings, and brick hearting laid in water lime mortar. By this mode, the quantity of masonry was much reduced, yet the whole remains water-tight and substantial, after being worked 20 years.

"About the same time, and on the same canal, it was found necessary to cross the river Dee, at the bottom of the celebrated valley of Llangollen, at Pontcysylte; at the height of 126 feet 8 inches, above the surface of the river, and for 1000 feet in length, it was cheaper to aqueduct than embank. Here Mr. Telford introduced a still more decided deviation from the usual form; by building upright piers only, and, instead of masonry arches, putting cast-iron ribs between them, constructing the canal part by cast-iron flaunched plates for the sides as well as the bottom, and in order to preserve, as much as possible, of water-way, projecting the towing path over the water in the canal. The canal part is 12 feet in width, which admits boats of 7 feet beam, and a towing-path. This aqueduct has

now been worked about 15 years, and has answered the purpose for which it was designed; where the embankment commences, the height is 75 feet, but gravelly material being very convenient, rendered embanking cheaper than carrying the masonry and iron-works any farther.

"In the three magnificent aqueducts recently constructed upon the Edinburgh and Glasgow Union Canal, the modes of the two last mentioned aqueducts are combined, that is to say, the masonry of the arches and spandrels are preserved, as in Chirk, and cast-iron plates for the bottom and sides, as in Pontcysylte, are introduced within the masonry; how far it was judicious to incur the expense of providing two modes of security in the same structure, appears rather questionable. In Pontcysylte the upper parts of the piers only are hollow, with one cross wall in each; in the Union Canal, the piers are brought up hollow, with cross-walls from the foundation; this mode, with an equal quantity of masonry, embraces a greater extent of base, and having more external and internal surface, ensures better materials and workmanship."

An inquiry, preliminary to every other, regarding the practicability of forming a navigable canal through any tract of country, is, whether a sufficient quantity of water can be obtained to supply the elevated sections.

The supply must be not only enough for the locks, but for the waste by evaporation, leaks, and percolation through the bottom and walls. These last are, however, so inconstant, varying from the workmanship of the canal, the nature of the soil, the climate, and other causes, that no accurate estimate can be made of their amount, which could serve as a rule of general application. The accession of water to the canal, from rains, although it may in quantity equal the evaporation and leakage, must not be relied upon as forming a compensation to them; as in some seasons, a canal might suffer severely from a long continued drought. In considering this subject, in connexion with the practicability of supplying canals with water by the steam engine, we may take as an example, the water required to supply the Middlesex Canal. The line of this canal, which runs from Concord to Charlestown, a distance of 22 miles, is supplied by the water which flows through an aperture of 6 feet by 1 foot. The head of water being 2½ feet above the middle of the aperture, the mean velocity of the stream issuing from this aperture is, consequently, 9 feet per second, nearly. This gives to the canal 3240 cubic feet, or 2,015,000 pounds of water per minute. A good steam engine will raise 40,000,000 pounds one foot high, with every bushel of coal consumed; consequently, to raise the above supply of water 20 feet high, by the steam engine, would require an expenditure of fuel, equal to 1 bushel of coals per minute. Notwithstanding this, however, there may be situations where the advantages of a canal will prevail against even this expense, and in fact, in a few instances, in England, the summit levels are, wholly or in part, supplied with water raised from neighbouring fountains by the steam engine.

We have not room to go into the subject of the great change, so

often attempted, in the mode of moving boats on canals; we allude to the attempts to apply the steam engine to this purpose. It will be recollected, that the first experiments, for propelling boats by the steam engine, were made on canals. These resulted in failure, and many different plans, tested since, have terminated in the same way. Indeed, the difficulties of propelling canal boats by the steam engine, must strike any one, who attends to all the circumstances connected with it, as great, if not insurmountable.

Directions for bending, blowing, and cutting of Glass, for chemical and other purposes. Extracted from Chemical Manipulation. By MICHAEL FARADAY, F. R. S.

(Continued from page 222.)

52. A more delicate operation than any yet described, and one that requires considerable practice for its performance with even moderate success, is, the blowing of bulbs and other expansions, either in the middle or at the end of a tube. Facility will be best obtained by practising with a piece of tube about nine or ten inches in length, one-third of an inch in diameter externally, and one-tenth of an inch in internal diameter. The end is first to be closed; and then about two-thirds of an inch in length, of the closed extremity, is to be uniformly heated, until so soft as to bend from side to side by its own weight. The aperture is immediately to be placed between the lips, and by means of the mouth, air is to be propelled, for the purpose of expanding the soft glass. This must be done quickly, but cautiously; and as soon as the eye, which must be constantly fixed upon the heated end, perceives enlargement there, the force exerted by the mouth should be slightly diminished, and the operator should hold himself ready for its instantaneous cessation: for if the power which expands the glass at first, be continued in full force, the glass will suddenly burst out into a large, irregular, thin bubble, of no use. This follows as a natural consequence, for every enlargement of the bubble diminishes its thickness, and, consequently, its resistance, and at the same time increases its internal area, and in that respect increases the power of the air impelled into it; and if the enlargement take place quickly, so that the glass has not time to cool, it cannot but happen that the bubble should expand to a large size. To avoid this, air should be thrown in from the mouth only, and not from the lungs; as the glass expands, the force with which the air is impelled should be diminished: and the operator should not endeavour to finish the bulb at once, but having succeeded in expanding it to such a size that the internal diameter is five or six times the thickness of the glass, he should heat it again, and complete the bulb at a second operation.

53. The glass must never be blown whilst it is in the flame, for it is impossible to make it retain a uniform temperature there, but is always to be expanded in the air: as it swells, it must be continually

turned, and those parts which are thinnest brought to the lowest position; they are easily recognised by their sudden expansion, by a greater degree of transparency, and a peculiar reflexion from them, different from that of the neighbouring parts. They are directed to be brought into the lowest situation, because the glass in that position cools most rapidly, and, consequently, its further extension is prevented. The operation, to be good, must be quick, for the temperature of the thin glass is so soon lowered, that it cannot be done at all if not done rapidly. The bulb, when finished, should be round, set straight on the end of the tube, of uniform thickness at the bottom and sides, and without lumps and knots. The size will vary with its thickness, and the quantity of the glass heated.

54. These operations may then be repeated with tubes of different sizes. If their internal diameters are much smaller than that mentioned, as in barometer tubes, the end may be heated until almost solid, and even thrust up into a lump. This being uniformly ignited, should be blown until the air just begins to expand into a small bubble at the end of the bore, and then the temperature of the glass being well raised, it should be blown out into a bulb at once, being turned in the air, as before directed, during the operation. It will be understood from what has been said, that these bulbs will not serve for thermometers, because of the moisture they receive from the air thrown in by the lungs; but they are useful in the practice they afford, and for numerous experimental purposes.

55. Sometimes an expansion must be formed in the middle of a tube, and the operation, in general, resembles that just described. If the end of the tube be closed, the glass merely requires to be thickened and heated at the part to be blown out, and then expanded by the breath. If it be not closed at either extremity, then the finger or a cork must be applied at one end to close it, and the part being heated, the lips are to be applied to the other end, and the expansion made.

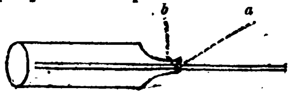
56. A little practice of this kind will soon enable the student to remove the knots at the ends of his closed tubes, (31) and make their terminations perfectly round, and of a uniform thickness. By similar trials he will succeed, perfectly, in forming little vessels, some of which are blown out of small tubes, whilst others may often be made without any blowing at all. For this purpose it is only necessary to take a piece of tube of proper diameter, or, if too large at first, it must be drawn down to the diameter required, (29) and contracting one part into a neck of such width as is necessary to be given to the intended vessel, (30) the flame is afterwards to be removed further down, to fuse the glass, which is to be contracted, drawn out, and closed. In this way, the body of the vessel is obtained of any required capacity, according to the length given to the piece of tube forming it. Or by warming the body, and then blowing it, it may be expanded until of a much larger size. The flask is afterwards to be separated from the remaining piece of tube, either by cutting it off with a file, (19) or drawing it off at the lamp to a fine termination, if required.

57. Two pieces of tube are sometimes to be melted together, so as to form one, with a continuous bore; and pieces of the same, or of very different thicknesses, may, if necessary, be joined. The ends should be straight, and of nearly equal diameter, so as to apply almost accurately against each other. If they are not so at first, the extremity of the larger one should be contracted until they become so. They should be brought into the flame so as to be raised separately, but, at the same time, to a good heat, that the glass may be quite soft; and then the ends, being applied to each other, should be pressed together in the flame, until the glass adheres in every part, and runs up into a ring round the tube. The ring should be immediately drawn down again, unless it be permanently required, and then, by working the glass in the flame, the joint should be brought into a good shape and condition. If, during the operation, the tube contract, it should be blown out (55;) if it become thin, it must be thickened (35) and pushed up; if it be thickened too much, it must be pulled out and rendered thinner, the contraction of the diameter occasioned by doing so being rectified by expanding the glass again. The joint, when finished, should not be of imperfect adhesion at any part, or be distorted in form, or involve any great irregularity of thickness, for then it will, almost certainly, fly asunder when cold. Small irregularities may be allowed to remain, and if the glass be well annealed, will do no harm.

58. It is of great importance in many experiments, to be able to seal a metallic wire into glass, so that the glass shall close round it and adhere to it, in a manner perfectly air-tight and sound. The detonating eudiometer tubes, and the tubes for the collection of gas, during the voltaic decomposition of liquid substances, or solutions, are common instances of their valuable application. Platina is the only metal which answers well for this purpose, and fortunately it is that which, in consequence of its chemical relations, is the most useful in such situations. The superiority of platina, depends upon its infusibility at the temperatures required to work the glass, and on the close agreement of glass and platina, in the rate of their expansion and contraction by changes of temperature. Other metals, as iron, differ much from glass, and when wires of these are inclosed in the most secure manner, they either separate, when cold, from the glass, by contraction, destroying the continuity all round them, or, if that does not take place, they retain the glass, in the immediate neighbourhood, in such a state of tension, that very slight accidents cause it to fly, and cracks to proceed from the wire into the glass, in several directions. This rarely happens with platina inclosed in the thickest glass, if the junction has been good, and the glass well softened.

59. Suppose a tube like that figured to be required, with a platina wire passing through it, and hermetically sealed into its summit. A piece of tube of the required diameter, thickness, &c., is to be selected, and also a piece of clean platina wire: the tube should be heated at the part where it is to be closed, and should be drawn out, so as to form a capillary neck, (35, 44) the end of the tube and the

neck being preserved of considerable comparative thickness, so that no occasion for afterwards increasing it shall exist. The neck should be of such internal diameter as freely to receive the wire, but no more; and, when cold, should be cut with a file, so as to leave the proportion represented in the figure, attached to the tube. The wire is to be introduced through the aperture thus opened, and placed in the position required, when the tube shall be completed. The point of the flame is then to be applied first to *a*, that the extremity of the aperture may become heated, and the wire also, the temperature being kept down to such a point as is sufficient to soften the glass considerably, but not to make it run; and both glass and wire being hot, a very little motion of the latter will cause the edge of the former to adhere to it all round, and make a tight, though not a strong joint. This done, the heat must be applied more towards the tube, so as to make the glass and the wire adhere gradually from *a* to *b*. This should be done without any twisting or distortion of the glass, and will be found more or less easy, according as the end of the tube has been well or ill prepared at first to receive the wire. Finally, all that part by which the wire is surrounded and held, should be raised to such a temperature as to make the glass soft and semi-fluid, that no irregularities in form or contraction may remain; the wire should be arranged so that it passes directly down the axis of the tube, and then the whole must be suffered to cool. It is erroneous in a beginner, to make the capillary end of his tube thin, and trust to thickening it after the wire is sealed in, by running the glass up. Such sealings are generally unsafe. The end of the tube should first be made of sufficient thickness, and then all that remains to be done is, to soften it so that it may collapse round and adhere perfectly to the hot wire, in every part of the joint.



60. When a tube of this kind is required for voltaic decompositions, having two parallel, but insulated wires sealed into its closed extremity, then a piece of platina wire, of sufficient length for the two, is to be bent in the middle, so that the parts may be parallel, at the distance of the eighth or the twelfth of an inch from each other. The extremities are to be fixed into a small piece of cork, which will retain the bent wire so steadily, that it may be worked with as a single piece. That part of the wire which is intended to pass through the end of the tube, and to be fixed in the glass, is to be brought into the flame of the lamp, and a thick filament of glass, or a thin rod, being held in the hand, its extremity also is to be softened in the flame, and glass from it worked upon the wires, so as to form a small bead, which, lying between them, shall also extend outside of, and inclose them on two of its sides, and, when cold, serve to tie them together, at the distance before arranged. This done, the end of the tube is to be prepared by drawing it down and contracting it, but only so much, that when the neck is cut off, (which should be done closer to the tube than in the former case) the aperture may be so large as to admit the passage of the double wire, but not of the bead

of glass upon it. The wire is to be dropped down the inside of the tube, so that its bent end may pass through the aperture, and the glass bead be received and stopped just within it; heat is now to be applied, to melt the bead and the end of the glass tube together, and the temperature is to be raised until the cohesion is perfect, and the joint well formed, after which, it must be allowed to fall. When the tube is cold, the piece of cork, now within, is to be drawn from the ends of the wire, and the wire itself is to be divided on the exterior, at the bend. It thus forms two insulated portions, which may be connected with the poles of a battery, and rendered active, in decomposing any solution put into the tube.

61. If a wire is to be inserted through, and sealed into the side of a tube, that part of the tube through which the wire is to pass, is to be softened in the lamp, and the wire pressed against it, until it appears in the interior of the tube: it should then be drawn out again in the same direction, and both tube and wire left to cool. The wire will be found coated with glass, which may be easily broken off. The tube will be drawn out at the place forming a conical projection, the end of which, when broken off, will afford a passage to the interior. The wire is then to be put into the aperture, heated, and the glass fused around it: ultimately the wire is to be pushed inwards, until that portion of glass which projected has been returned nearly to its first position. By a little practice, this may be done, so that the glass shall be in perfect contact with the wire on all sides, and with little disturbance as to its form, or the position from that which it possessed at first, the wire, at the same time, having the exact position required. If fears be entertained that, from the removal of glass on the wire, and by breaking off the end of the projection, enough will not remain to confer sufficient strength upon the tube in that part, it will be desirable, to put a bead of glass round the wire, in the manner just described, for double wires, and when the heat is applied, to work it into contact with the glass of the tube, that the latter may be of sufficient strength. When two wires are required in the same tube, at a certain distance from each other, as is necessary in a eudiometer, the distance is easily regulated by a little previous consideration; allowance being made for the extent to which the wires will require to be moved, before the operation is finished, and they are finally fixed in their places.

62. When green bottle glass tubes are to be worked and submitted to these operations, they will be found of more difficult performance, because of the much higher temperature required for the fusion of this glass. Generally, it is only the simpler operations that are necessary with green glass, such as bending, closing, or lengthening a tube. These may be performed readily, by means of the table blow-pipe; and as, from the greater strength and infusibility of green glass, it frequently happens, that a thinner tube may be used of this substance, than of flint glass, a greater facility in the operation is thus obtained.

63. The use of the spirit-lamp in these operations on glass, even when not urged by a blow-pipe, has been noticed more than once.

When its powers are increased by the application of the blow-pipe, it may often be made to perform the work of the table-lamp; generally not so well, though very usefully; sometimes quite as well; occasionally even better. Small tubes may be bent, closed, drawn out, extended, and worked, in almost any way by its means; and moderately large tubes, viz. from one-third to half an inch in diameter, may be bent and closed by it. If no other kind of blow-pipe than that of the mouth be at hand, it must be turned to account in the best manner possible. For this purpose, the mouth-piece of the blow-pipe may be placed between the lips, and the instrument supported without any help from the hands, being allowed to hang from the mouth with its jet opposite to the flame of the spirit-lamp. The flame may then be urged, whilst both hands remain at liberty for the purpose of moulding and working the glass. The student will, at first, find it difficult to hold the blow-pipe so steadily in his mouth, as to produce a certain and regular flame; but he may obtain assistance by placing a block of wood, a book, a weight, or a brick, upon the table, between himself and the lamp, at such distance from the latter, that the back of the blow-pipe may bear slightly against it. The pressure may be easily regulated by the mouth, and will be quite sufficient to render the blow-pipe, and, consequently, the flame itself, perfectly steady.

[TO BE CONTINUED.]

ENGLISH PATENTS.

To CHARLES PHILLIPS, *Captain in the Navy, for improvements on Capstans.* Dated June 8, 1827.

THE improvements on capstans, stated in the specification of this patent, are intended for a species of double capstans, for which captain Phillips had before obtained a patent. These double capstans consisted of two capstans on the same spindle, which were, of course, to be worked on two different decks, and the upper capstan of which was fixed to the spindle, while the lower one might be turned round independent of it, but had a clutch-box placed over it, that was moveable only upwards and downwards on a square or hexagonal portion of the spindle, and which, when let down, connected the lower capstan with the spindle, but when raised up again, left it at liberty: beneath this lower capstan, a stout pinion, or small toothed wheel, was fixed to the spindle, whose teeth interlocked with those of three other similar pinions of the same size, placed at equal distances round it, which were supported by a disk of metal, that revolved round a turned part of the spindle, and had another disk above them to keep them steady, and were connected to the two by their axles, which entered into both a sufficient distance; the teeth of these three outer pinions were again interlocked with those of an internally toothed ring, that surrounded the whole, and which was

fastened in four opposite places by projecting pieces to a circle, or thick ring, that was fastened to the deck beneath the capstan, and in the edge of which the notches were made, in which the falling palls of the capstan entered. This machinery, (first used for the same purpose as what is called the sun and planet wheels, employed by Mr. Watt, with the momentum wheels of steam engines,) by being made to act in a reverse order, gives a great increase of power to the lower capstan, accompanied by a proportional diminution of velocity; which renders it expedient only to employ the whole power of the engine, when very great resistances are to be overcome, and at other times, when less force is required, a degree of it better suited to the purpose may be obtained, by lowering the clutch-box, and thereby uniting the two capstans, and, at the same time, withdrawing the lower bolts, that connected the lower capstan with the multiplying machinery.

In the former arrangement of the capstans, the clutch-box was worked by two balance-levers, placed above it in the direction of the opposite radii of the capstan-head, and supported at their centres by two uprights that arose from the top of the lower capstan, the inner ends of which were fastened to the clutch-box by chains or loops, while chains descended from their outer extremities to two vertical bolts, that passed downwards through the bottom of the lower capstan, in the space between the whelps, into holes prepared for them in the upper disk, belonging to the three external pinions of the machinery before explained: and by this means, when the clutch-box was lowered, the bolts were drawn out by the rising of the outer ends of the levers, which this occasioned, and the multiplying machinery ceased to be connected with the lower capstan.

The improvements comprised by the present patent, relate to this latter part of the apparatus, all the other parts being the same as before; and, according to the directions given respecting them, the clutch-box and levers are to be superseded, and a plain disk to be fastened to the spindle of the double capstan in their stead, through which two strong vertical bolts being let down into the head of the lower capstan opposite to each other, connect it with the spindle when required; and again, when these bolts are drawn up, the lower capstan becomes separated from the spindle. These bolts, when raised, are prevented from descending again, until required, either by pins, that pass through holes made in them, or by catches which embrace annular cavities formed round their middles. Instead of the disk, a straight bar may be also used for holding these bolts, furnished at either end with vertical perforations for that purpose, and having a square or hexagonal cavity or enclosure, at its middle, by which it is fastened to the spindle. The vertical bolts at the bottom of the lower capstan, are to be raised by hand, when the upper ones are let down. This arrangement the patentee thinks preferable to the first, on account of its greater simplicity, and from its giving the two capstans a greater range in their operations. [*Repertory.*

To Edward Barnard Deeble, *Engineer, for his new construction or constructions, combination or combinations, of Metallic Blocks, for the purposes of forming caissons, jetties, piers, quays, embankments, light-houses, foundations, walls, or such other erections, to which the same Metallic Blocks may be applicable.* Dated July 12, 1827.

Mr. Deeble's metallic blocks, are cases, made of cast-iron or other fit metal, of various forms, according to the uses for which they are intended, from some of the vertical sides of which, dove-tailed ledges project, while in others of their sides corresponding dove-tailed grooves are formed; by slipping down the first of which, belonging to some of the blocks, into the latter belonging to others, the whole may be connected firmly together, into the sort of erection best suited for the work required; some idea of which mode of connexion may be obtained by observing the manner in which the pieces of the dissected maps, intended for uniting instruction with amusement for youth, are combined together.

In the drawings of the specification of this patent, twelve figures are given, of what may be called the elementary forms of these metallic cases; one of which, intended for straight walls, is a rectangular oblong prism, with a projecting dove-tailed ledge at one end, and a dove-tailed groove in the other extremity, for connecting pieces of this shape as mentioned; another form, designed for curved walls, is a triangular prism; a third, is a hexagonal prism; both of which have grooves and ledges as the others, but differently disposed: a fourth, of a more complicated shape, has a flat bottom, or one slightly curved, straight sides, and an arched top, at the upper part of which a dove-tailed groove is made, which is intended for the reception of two dove-tailed ledges of half its size, formed on the extreme angles of the bottoms of two other cases of the same shape; by which construction, when several of these cases are united, they present an appearance slightly resembling the vertical section of a honey-comb; and a fifth sort has a large re-entering angle at one of its sides, into which parts of one or two other cases may be fastened by grooves and ledges. By which combination, variations of the shape of the walls may be produced, as may be required; and the rest of the twelve figures are varieties of the others, showing different dispositions of the grooves and ledges, and of other parts, as best suited to various kinds of work.

Fifteen figures are exhibited, of the several combinations of these elementary forms; two figures represent simple connecters for the cases, used on some occasions, one of which is a double dove-tailed ledge, for uniting two cases by their opposite dove-tailed grooves; while the other consists of a dove-tailed groove in the flat side of a small semi-cylindrical prism, by which two half dove-tailed ledges on the adjoining angles of two cases may be firmly clasped together. And three more figures (which make the number of the whole amount

to thirty-two) show the construction of a species of tackle, that the patentee has contrived, for lowering his metallic blocks into the sea or other depth; or for elevating them to a higher level, as may be found expedient.

The cases, for some purposes, may be made open at one side, or at two opposite sides; and instead of having solid sides, may have them constructed of open work of various devices. The thickness of their sides may, likewise, be varied from that of half an inch, to the extent of one or more feet; and though cast-iron is the substance in most instances contemplated by the patentee for their formation, he, however, claims the use of other metals or alloys, for the same purpose, if he shall give them a preference. The internal hollows of these cases, are to be filled up with stones or bricks, along with common mortar, or tarras cement, as may be best suited to the uses for which the erections made by them are intended; and as among the several applications of the cases, the patentee expressly designs them for the construction of caissons for erecting the piers of bridges, he states that, on this or other occasions, he claims the use of piles, both within their hollows, and outside their faces, for the more firmly connecting them with their foundations, and making the latter more substantial and unyielding. The metallic cases of a rectangular form, without tops or bottoms, are chiefly to be used for these caissons, and their hollows are to be filled with clay, or other substances commonly employed between the enclosures of caissons formed of piles, instead of the materials directed to be used for this purpose on other occasions.

The "tackle," or apparatus, contrived by the patentee for raising or lowering down the metallic cases, consists of two strong bars of wood or iron, united at their centres by a pivot, which permits their ends to be separated from each other at any angle; four strong cords, or chains, ascend from rings placed near the extremities of these bars, and are joined above to a box of pullies, which, by a rope properly passed through them, are connected with similar pulleys on the top of shears or some other support, in the usual manner; from the middle of each of the internal sides of each case, near its top, pieces project an inch or two, under which the ends of the cross bars are put, and the cord of the tackle being then pulled by any adequate force, will draw the case upwards, so as to be supported entirely by the tackle; from which situation, on the case being lowered down and adjusted in the place where it is to remain, the bars are made to disengage themselves from the projecting bits on its inside, by means of two short bars of equal length, that are connected to two of the ends of the sustaining bars, which are next to each other, and to each other by joints, and a cord ascending from the latter joint, which is in the middle between the other two; by pulling this cord, any of the workmen near the shears may cause this middle joint to rise, and will thereby bring the ends of the sustaining bars sufficiently close to each other, to make them pass sideways from under the projecting bits of the case; and will thus entirely free the tackle

from it, so as to be ready for a similar application to another case, as soon as may be required.

In joining a number of the cases to each other, in the construction of a wall, they may be so placed that the joints of one row may be opposite to the centres of the cases in the adjoining rows, as bricks are arranged in ordinary walls; by which the fabric will be connected together with more firmness and solidity.

OBS.—There is much ingenuity exhibited in the forms of Mr. Deeble's metallic cases, and in the means used for connecting them together; it is, therefore, with much regret, we have to remark that cast-iron, which is the only material that could be cheap enough for their construction, is very unfit for works that are to be covered by the sea, as it is affected in a very extraordinary, and as yet unaccountable manner, by sea water, so as to have its consistence entirely destroyed, and be reduced to a state in which it may be cut by a knife; as has often been proved by the condition in which cannon are found, that have lain any time at the bottom of the ocean, from shipwrecks or other causes: and we even recollect an account being published a few years ago, of some cannon so situated, the pieces taken from which grew so hot on being taken up and exposed to the air, that they could no longer be handled; which showed that the cast-iron was converted into a species of pyrophorus, by the action of the sea water.

Any other metal but iron, would, evidently, be too expensive for the construction of these cases, and we also think that malleable iron could not be obtained sufficiently cheap for them, though the only metal of whose fitness for the purpose there could be any rational hope, for the reasons we have given. [*Ib.*

To PIERRE ERARD, *Musical Instrument Maker, for improvements in the construction of Piano-fortes: communicated by a Foreigner.* Dated 20th February, 1827.

THE object of this patent is, to extend the improvements on grand piano-fortes, for which Mr. Erard obtained a patent in 1825, to those of a square form, and of other shapes, and also for some additions to, and variations of those improvements.

The hammer, or part that strikes each string, has its centre of motion in front, and the key on which the finger is pressed, extends considerably backwards beyond its head; the farther end of this key is kept down by a spring which keeps the outer part at a due elevation for the action of the finger, and a balance lever, a few inches in length, runs along the top of its inner extremity, on which it is fastened to two small metal uprights by a pivot, which passes through the three, so as to allow it to move freely up and down a short distance; a strong wire bent at right angles, whose lower end is screwed into the frame, rises above the farther end of this lever, and turns

over it beyond its angle, at a proper distance, to stop it from rising farther, when it is thrown into contact with it by the action of the finger, and to cause the near end to fly up; and by a vertical striker, which ascends from it to drive up the hammer with increased velocity, by striking its stalk pretty close to its centre of motion. Which arrangement altogether gives sufficient length of lever, from the combination of the leverage of the key, of the hammer, and of the upper lever, to cause the head of the hammer to strike the string with sufficient velocity, while the key itself is so much shorter than usual, as to admit of a considerable reduction of the breadth of the instrument. This account will serve to explain the principle of the action of the key, but its simplicity would little accord with Mr. Erard's, apparent love of complication, and he has, accordingly, added to the key, besides the parts we have mentioned, two short levers, and springs, above the first, holding a second striker, (which acts in raising the hammer for part of the distance, while the first completes the stroke, and which is detached by a contrivance for the purpose, as soon as the first begins to act,) and a catch, with a wedge-shaped top, that passes by the stalk of the hammer, and prevents it from rebounding; a damper also, that is pressed against the string by a combination of three or four pieces between it and the end of the key, is elevated by the latter, when pressed by the finger; so that each key sustains a little forest of levers, springs, catches, and intermediate parts. A method is besides mentioned, of connecting a damper of the common form, with the key, which completes this part of the instrument.

The rest of the specification relates to the frame work beneath the sounding board; which consists of several strong parallel pieces of wood, placed a small distance apart lengthways, and tenanted into other pieces, that go across the instrument; and of longitudinal bars of iron, which the patentee calls "arcs," that are kept above the sounding board by iron uprights, which are screwed to the long parallel pieces of the frame in several places.

The instrument is entirely open at the bottom; and the hammers are fastened to hinges that are placed alternately in two different rows of elevation close to each other, which permits the hinges to be of greater breadth, so as better to prevent lateral motion, than could be effected if they were placed in one row. The pins that hold the strings, pass through metal plates, screwed to the frame, but this the patentee does not claim as his invention, and the other parts of the instrument, not particularly described, are to be made in the usual manner, according to the peculiar shape for it required.

Obs.—The remarks on Mr. Erard's patent for improved piano-fortes, granted in 1825, (which may be found in the 1st volume of our present series, p. 114,) will also, for the most part, apply to the present patent, particularly with regard to the complicated apparatus placed on the ends of the keys; which, with the springs, would, we think, make them require as much force to press them down as those of some church organs. We have, however, ascertained, that the

longitudinal bars and iron braces added to the frame of a piano, do not injure the tone of the instrument, as we first apprehended, having examined one of the large species so constructed, in company with a very experienced musician; but as none made on the present patent were ready for inspection, we can say nothing of these from actual examination. [*Ib.*

Abstract of the Specification of a Patent granted to JOHN *and* SAMUEL SEAWARD, *Engineers, for a new or improved method or methods of propelling Boats, Craft, and all kinds of Vessels on Canals, Rivers, and other Shallow Waters; and also Locomotive Engines, Vehicles, and other Carriages on Roads.* Dated November 1, 1825.

OUR said invention of a new or improved method or methods of propelling boats, craft, and all kinds of vessels on canals, rivers, and other shallow waters, and also locomotive engines, vehicles, and other carriages on roads, is fully described and ascertained in manner and form following: First, our method or methods of propelling boats, craft, and all kinds of vessels on canals, rivers, and other shallow waters, consists in employing a wheel or wheels to turn or revolve upon the bottom of the canal, river, or other shallow water, or against the sides thereof, and by that means propel or draw, according as the wheel may be placed, the floating vessel forward, to which the said wheel or wheels may be attached.

The wheel or wheels above mentioned we call propellers; and when necessary to guard against it or them from sliding on the ground without proceeding forward, we arm the periphery with projecting knobs, or other contrivances, well known to engineers, by which means the propeller will catch firmly hold of the ground, and propel the vessel with adequate force. Or the propeller may be formed of a boss on its axis, with a circular series of projecting arms or radii, similar to a wheel without its periphery. In general we employ only one propeller for a boat or vessel, and place it in an opening or well through the bottom of the boat or vessel; the well of course closed all round to prevent the admission of water into the boat or vessel; it may, however, be placed at the sides without passing through the bottom of the vessel, or at one or both ends, as may be found most convenient; and instead of one, two or more propellers may be used, placed in suitable situations, either in a vertical, horizontal, or oblique position, to turn or roll on the bottom, or against the sides of the canal or river. The methods of connecting or attaching the propeller to the vessel or boat, and giving it a rotary motion, are various; we shall, however, proceed to describe two or three ways, which we prefer employing for that purpose.

If the bottom of the canal or river is level, and the depth of water

every where the same, it will be sufficient to hang the propeller on a suitable shaft, moving in fixed bearings, such as the crank shaft of a steam engine, or other moving power, and, if the propeller be made of suitable diameter to touch the ground or bottom, it will by its rotary motion, cause the boat to advance. If the bottom of the canal or river is uneven, the projecting arms, radii, knobs, or other contrivances used for this purpose, may be made to slide in and out of hollow spokes freely of themselves, by which means the diameter of the propeller will accommodate itself to the unevenness of the ground.

When the depth of water is various, or the bottom very irregular, we employ a hanging or swinging frame, one end of which frame is attached to the crank shaft of a steam engine, or other moving power, and allowed to swing freely thereon. To the other or vibrating end is fixed the propeller by means of a shaft or axis, running on suitable bearings; by this means the propeller will rise or fall, and accommodate itself to the various depths of water, or to the inequalities of the bottom of the river or canal: or the ends of the axis of the propeller, or the bearings in which they work, may be made to rise and fall in circular grooves, concentric with the crank shaft aforesaid; and other similar contrivances may be adopted to cause the propeller to adapt itself to the depth of water.

To give the requisite rotary motion to the propeller when employed with the swinging frame, circular grooves, or similar contrivances, we employ two drum wheels, one fixed on the crank shaft, and one on the axle of the propeller, with an endless band or chain, by which the necessary motion will be communicated; though tooth wheels and many other contrivances may be employed for the same purpose.

We claim as our invention the propelling boats, craft, and all kind of vessels on canals, rivers, and other shallow waters, by means of a revolving wheel or wheels, arms or radii, working either on fixed centres, on swinging frames, in circular grooves, or with other suitable contrivances, and rolling or turning on the bottom, or against the sides of canals, rivers, or other shallow waters; however, or by what means soever the said wheel or wheels, arms or radii, are made to revolve or turn round.

To WILLIAM JOHN THOMPSON HOOD, *Lieutenant in the Navy, for improvements on pumps, or machinery for raising or forcing water; chiefly applicable to ships.* Dated May 26th, 1827.

To form the apparatus, for which this patent has been obtained, an air-tight case, or coffer, about six feet long, five broad, and two deep, formed of boards grooved and tongued together and secured by screws, is fixed immediately under the middle of the lower deck of a ship. This case is divided longitudinally into two equal parts by a vertical partition, and one of these is again separated into three compartments by two similar partitions that pass across it at right

angles to the first; from the middle one of these last mentioned compartments a square wooden trunk, or a metal tube, whichever be preferred, is carried down to the kelson, and as the middle compartment need be but little larger than what will admit this tube, it of course is the smallest of the three; the lower part of the trunk or tube is surrounded by gratings, sloped downwards at each side of the kelson, and continued across the space underneath the limbers, to prevent solid bodies of any sort from entering into the tube, which is furnished with a valve opening upwards similar to that used in other pumps. From the two compartments at each side of the middle one, tubes ascend above the lower deck furnished with solid pistons, the alternating motion of which, effected as will be described, raises or forces the water as required; and from the large compartment left in the first division of the coffer, two other tubes ascend above the deck, over which the water is to pass on its way to the scuppers, and are intended merely for conveying the water from the coffer, but are furnished with valves opening upwards to prevent its return.

To work the pistons in the two tubes that contain them, a vertical wheel is placed above them of such a size, and in such a position, that the ends of its transverse diameter are directly over the centres of the two tubes, and to this wheel chains are fastened, which pass over its periphery at each side to the pistons; and these chains being of such a singular structure, (which, however, is not explained in the specification,) that when pressed down by the motion of the wheel, they become equally unyielding as a piston rod, they, of course, press down the pistons with the same facility that they draw them upwards; and large vertical valves, that open outwards, being placed at each side of the middle compartment, from whence the tube descends to the kelson, and two other similar valves opening into the large division of the coffer, from the two side compartments, it follows, that when the pistons are drawn upwards, they will raise water from below into the coffer, and when they are pressed down, that they will force it upwards from the coffer by the pipes that ascend from the large compartment. The large vertical valves are, it is stated, so constructed as to be detached from the coffer, without its being requisite to open it for this purpose, but the mode of doing this is not described with sufficient accuracy, for any practical purpose.

The wheel that works the pistons, receives an alternately reversed motion, by rods that ascend from the ends of its transverse diameter, to cranks on the upper decks, which are turned by hand, by the same sort of apparatus by which chain pumps are worked; and as these may be multiplied as required, and be made to act simultaneously by rods of communication, any force necessary for raising the water may be readily attained.

This water engine may be also converted into a machine for extinguishing fire, by closing the lower descending tube and the two ascending tubes by stoppers, which are worked by long screws that pass through the top of the coffer, and by turning cocks in pipes that

pass through from the coffer to the sides of the ship, and screwing on leathern hose to the top of the compartment.

OBS.—It appears to us, that the coffer used in this apparatus, would take up much room to very little purpose, and that if constructed as described in the specification, it would be kept watertight with the greatest difficulty, on account of the great pressure from within, that would take place when the pistons were pressed downwards, which acting on so large a surface, would constitute a force of more than 37 tons, operating to burst the coffer, if the water had only to be raised 15 feet higher than its surface. Any advantage that could be acquired by this apparatus, which appears to us extremely clumsy and cumbersome, would, we think, be obtained much better, and with infinitely less risk of derangement, by La-Hire's double-acting forcing pump, (an account of which may be found in most modern elementary treatises on hydraulics,) which appears to us to be peculiarly well calculated for ships, from its simplicity, and the facility with which it may be repaired in case of accidents.—*Ib.*

To HUGH EVANS, *Lieutenant in the Royal Marine Corps, and to* WILLIAM ROBERT HALE KING, *Tin-plate Worker, for a new Table Apparatus to promote the ease, comfort, and economy of persons at sea, or on nautical excursions.* Dated 12th June, 1827.

THIS table apparatus for the use of ships, consists of a deep ring, or hoop of metal, of a size proper for supporting a dish, to which is attached by joints several smaller rings, and other contrivances, for holding decanters, tumblers, wine glasses, knives and forks, and other dinner utensils, and also a strong screw clamp, by which the whole may be firmly fixed to a table.

The smaller rings are of different sizes, according to the purposes for which they are required; and the large ring being about two inches deep, to the top of which they are jointed so as only to have a lateral motion, there is a sufficient space left between them and the table, to enable them to have a fast gripe on the articles placed within their peripheries.

The contrivance for holding wine glasses consists of two half rings having a straight spring projecting from one of their extremities, (by which they are attached to the large ring by the sort of joint above mentioned,) and of other pieces curved outwards from their other ends, which serve as guides for the admission of the glasses into the circle formed by their conjunction, where these are retained by the action of the springs, which are so shaped as to be moveable only in the plane of that circle.

To hold knives and forks, strong wires project from the sides of the large ring, having two or more vertical loops of the breadth of the handles formed on them by flexure, by which loops one end of

each of these instruments is supported, while their other extremities rest on the table.

The clamp is so jointed to the large ring as to move in a direction at right angles to its plane; but only towards its centre from without, being prevented by a stop from moving farther outwards than is necessary for placing the ring level with the table. The screw of this clamp lies beneath the table, when it is properly fixed, and on being turned binds the ring to the table, so as to prevent it from separation by any of the motions of a ship. The joints of the several pieces attached to the large ring, are intended for the purpose of turning them round, so as to lie within its circumference, when the apparatus is not required for use; in order that the whole may occupy less space, and be laid by in a case or locker with more conveniency.

A clause of variations is added to the specification, to extend the number and form of the pieces jointed to the large ring, and the application of the whole to breakfast and tea services, and to other purposes, not stated, as well as to the retention of the utensils required at dinner.

OBS.—Messrs. Evans and King's apparatus appears to us to be well calculated for the purposes for which it is intended; though we cannot perceive any remarkable advantage that it has over the trays with two bottoms, the upper one of which is perforated with numerous apertures of different sizes, for the retention of the several vessels, and other articles required at meals, in a similar manner: the latter seeming to us to be equally capable of preserving them from precipitation and fracture, or sudden extraordinary rollings or pitchings of the ship, if only properly fastened to the table, which every seaman knows well how to do, without going to the enrolment offices for instructions.—*Ib.*

To JOHN ALEXANDER FULTON, *Spice Merchant, for his invention of a Process of Preparing or bleaching Pepper.* Enrolled May, 1828.

THE object of the patentee is, to remove the external skin or black coating from pepper, in order to render it white. The mode of effecting this object is, by steeping the pepper in water for the space of a day, or more, sometimes a week may be necessary; and then placing a considerable quantity of it in a heap, so as to become heated; in which process the skins will very soon rot or become decomposed, and readily separate from the peppercorns within them.

The decomposed skins may now be removed by washing the pepper in water, and agitating it until all the black part is effectually washed off. The pepper is after this to be dried by exposure to the air, or in any other way that may be found convenient for drying corn or seeds.

In order to bleach the peppercorns, after they have been treated as above, oxymuriate of lime may be employed, or it may be submitted to the fumes of sulphur. [*Lond. Journ.*

To Francis Halliday, *Esq. for his invention of certain Improvements in raising or forcing Water.* Enrolled February, 1827.

This is a sort of rotary pump, constructed upon the same principles as the rotary steam engine invented by the present patentee in 1825.

A wheel, carrying four vanes as pistons, works through the middle of a semi-circular chamber. One end of this chamber is open, and sufficiently wide to admit the broad faces of the pistons; the other end is closed, excepting at the narrow space through which the wheel passes edgewise, and fits tightly.

The wheel is proposed to be placed horizontally, and to turn in that direction upon a vertical shaft. The semi-circular chamber is, of course, horizontal also, and, with the wheel, is intended to be placed at the bottom of a well, or other reservoir, from which the water is to be raised.

The semi-circular chamber being immersed in the water, and open at one end, will, of course, be filled with water, and the vanes or pistons, as the wheel goes round, entering the chamber in succession, will shut in the volume of water immediately before it, and press the water towards the closed end of the semi-circular chamber, where, being unable to escape, it will rise in a perpendicular pipe leading upwards from that end of the chamber.

It has been said, that the semi-circular chamber, lying in a horizontal position at the bottom of the well, is open at one end, by which the water flows freely into it, but that it is closed at the other end, except a narrow channel through which the wheel passes edgewise, fitting the opening closely. Now each piston attached to the wheel, in entering the open end of the semi-circular chamber, presents its broad face to the volume of water, and its edges fitting the internal part of the chamber closely, of course, the volume of water is driven forward by the piston, until the piston next following enters the chamber, and brings forward another volume of water, and so on. When the first piston has performed its duty, that is, brought the volume of water forward, an arm on the outside of the wheel, attached to the axle of the piston, strikes against a projection, and turns the piston round edgewise, which shuts it into the face of the wheel, and allows it to pass with the wheel freely through the narrow channel at the closed end of the semi-circular chamber.

In this way the successive pistons will continue as the wheel revolves, to drive the volumes of water along the semi-circular chamber, and, consequently, to force it up the perpendicular pipe, by which means the water will be continually rising from the well, or reservoir below, to the discharge-pipe above, and so pass off at a higher level.

It is scarcely necessary to add, that the rotation of the wheel carrying the pistons, may be effected by means of bevel gear at top, and which may be driven by a winch or by any other power. [*Ib.*

Observations on the attempt to construct machines of the kind usually intended by the term Perpetual Motion; with notices of some of the particular machines which have, at different times, been proposed for the attainment of this object. By the Editor.

[With a copper plate.*]

It will not be expected, by those conversant with the inquiry, that any thing really new can be offered on a subject which has been so frequently, and so ably handled, as the inquiry into the possibility of constructing a machine which has *within itself* a principle of continued motion. There is something extremely fascinating in the pursuit of this object, as is evinced not only by the attempts of a host of tyroes in mechanics, but by the persevering efforts of some men of genius and science; who, although they have professed faith in the admitted laws of motion, have yet proved by their works that their faith was not perfect. Whilst there is nothing in the known laws which govern the material world, upon which to found the idea of being able to construct a perpetual motion, the time might not be misspent which should be devoted to an investigation of the causes which operate upon the mind, in exciting, and keeping alive, the expectation that such a machine will, some day, be discovered; but, if we possessed the ability fully to prosecute this investigation, it would belong more to a work devoted to moral than to mechanical philosophy.

Some of our readers may be ready to exclaim, 'but we have always understood that all philosophers denied the possibility of any such thing.' We believe that all who really merit the name of mechanical philosophers do unite in such a denial; but if this be the fact, the corps is but a small one; for our own observations, together with the numerous facts upon record which might be called as evidence, go to prove, most clearly, that there are but few persons who admit this truth as they admit an axiom; there appears in general to exist some mental reservation; some apprehension, that if they declare the thing impossible, it may, nevertheless, happen that some lucky wight may 'hit upon it,' and ruin their reputation as accurate philosophers.

The subject of mechanics is one which, of necessity, occupies a large portion of the attention of mankind; all the moving powers which we can command are called to our aid, but into their actual employment and adaptation, there enters much more of practice than of principle. A great proportion of our mechanics are men of observation, intelligence and experience, and many of them have paid a praiseworthy attention to science; but their very pursuits and occupations, although greatly aided by the scientific knowledge they may have acquired, forbid their carrying such investigations to a great extent; and we ought not, therefore, to be much astonished if some of them are occasionally engaged in this fruitless pursuit; to their credit, however, this is now a rare occurrence, as the obser-

* By mistake marked April.

vations founded upon a correct practice must, necessarily, lead to the same general results, as does a correct theory. The constant employment, or notice, of the various machines which are seen in daily operation, induces almost every man to conclude that he knows something of mechanics. In many of these machines the cause of their motion is very obscure, whilst the motion itself is not only evident, but so uniform and continuous, as may well lead the ordinary observer astray, and cause him to conclude, that the step from some of them, to an actual perpetual motion, is but a short one.

There are but few terms in our language which are less definite than the term science; it embraces almost every department of human knowledge, whether natural, moral, or physical; and it happens unfortunately, that when philosophers and men of science are mentioned, the world is not very discriminative, and the opinion of the adept in natural history, or in chemistry, will carry an undue weight on subjects to which he has not attended, and of which, although he is *a man of science*, he is nearly or completely ignorant. It is in this way certainly, and in this only, that the votaries of science, and the believers in a mechanical perpetual motion, have been identified. On which side were the scientific of Philadelphia ranged when Redheffer's machine was exhibited at Chesnut Hill? Those who recollect the period will find no difficulty in answering the question. We believe that nineteen-twentieths of those who were so esteemed were either avowed believers, or, as the politicians would say, *upon the fence*. We knew one gentleman who professed, and was believed to be, a man of great mechanical knowledge, who delayed completing a patent, lest Redheffer's machine should be found to be genuine. We are of opinion that there is scarcely any other subject so familiarly spoken of, and so little understood, as the principles of mechanics, and no one, therefore, in which quackery is more certain of success.

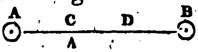
Let not our readers expect, although we have thus freely spoken our sentiments, that we are about to demonstrate that a mechanical perpetual motion is an impossibility; we should be willing to take any particular machine which might be pointed out to us as such, and undertake to show the fallacy of its claim; but to give a general negative demonstration is a task which we cannot undertake. It belongs to those who advocate its possibility, to establish a principle upon which it may be made to act; the general practice, however, has been, to exhibit a complication of levers, weights, or other powers, which serve to obscure the action of the individual parts, and to claim for the whole, effects to which these individual parts, taken alone, have no power to contribute.

It has been, we think truly, observed, that to produce a perpetual motion we must find a body which is, at the same time, both *heavier* and *lighter* than itself, and in which the action and re-action may consequently be *unequal.* This is, manifestly, a physical absurdity, and although many attempts have been made to cheat bodies out of the properties with which nature has endowed them, no one has had the hardihood to deprive them of their essence in a legitimate way.

To investigate the laws which obtain in the motion of bodies would require a treatise of no mean length; this, therefore, we cannot attempt, but think it necessary to offer a few remarks upon some of them, and particularly upon the property denominated *inertia*, and upon *momentum*.

The very words which we employ to designate a particular thing are frequently permitted to lead us into error, in consequence of our not restricting our terms according to the nature of the thing to which they are applied; thus we frequently use the expression, 'the power of inertia,' which may lead to the conclusion, that from this property of matter some *power* may be derived, although the very term inertia is intended to express the simple fact, that matter is altogether inactive or powerless. Inertia is a mere nullity, and, therefore, instead of conveying the idea of power, it is intended to express the entire absence, rather than the existence, of a property. If this be true, inertia can give us no aid in producing a perpetual motion, for, supposing, for the sake of argument, that gravitation, friction, and a resisting medium could be placed out of the question, as every single impulse which is given to matter tends to carry it in a right line, whatever deflected it, must necessarily abstract from, and eventually stop its motion. All our machines must have either a vibratory or a curvilinear motion, or they would, from their very structure, soon elude our grasp; any impulse which we give to them, cannot, therefore, be continued in consequence of the inertia of the matter of which they are composed. But we must also, and at every moment, encounter friction, and a resisting medium, and in consequence of these, our machine must eventually lose whatever impulse we may have given to it; for although matter is indifferent both to rest and motion, it is not so to impulse, or, which is the same thing, to resistance; and whether we abstract from its motion by grains, or by ounces, it must eventually cease. Upon this it is unnecessary to dwell, because the fact must be admitted, on all hands, to be as stated. But if inertia, or the absence of power, cannot give power to a machine, may we not obtain something from *momentum?* Momentum is the quantity of motion, and is compounded of the quantity of the matter moved, and the velocity with which it moves. The case we have been considering under the head of inertia, is a case of momentum; as we have supposed a certain impulse given to matter, which matter has in consequence acquired motion, and which motion, from inertia, would be continued were there no counteracting causes. If we give a double velocity to our machine, or mass of matter, as to a wheel for example, we give a double momentum, or what is the same thing, a double quantity of motion, and it will only require a double space of time *cæteris paribus*, to exhaust this motion; we have not, therefore, advanced a single step towards perpetuity. It consequently is not in this way that aid has been sought from momentum, but in one which, although it is equally fallacious, is better calculated to deceive. We have already observed that the momentum of a body is increased by increasing its velocity, or the space through which it

passes in a given time, although its quantity of matter remains the same. Suppose we have a lever, or bar, with equal weights at each end, supported by a fulcrum between them, thus,



A and B are equal weights, but the fulcrum C, is but half the distance from A, at which it stands from B; when allowed to move, B will preponderate, and will move with a velocity which will be double that of A, that is, it will descend 2 inches, whilst A ascends but 1, its momentum, power, or quantity of motion, will, therefore, be double. If, now, we could cause the fulcrum to change its place from C to D, and from D to C, alternately, each of the weights would preponderate in its turn, and a perpetual vibration would ensue. How an effect of this kind has been attempted, will be seen upon an examination of some of the plans to be presented.

In many instances the machines have been made so complex, as to render an analysis of them somewhat difficult, even to well informed observers; this complexity, however, instead of promoting the desired end, only renders a larger portion of foreign aid necessary to produce and continue the motion.

Numerous impositions have been practised by individuals who have pretended that they had made self-moving machines. When deceptions of this sort have been practised, the charlatans have, of course, endeavoured to perpetuate the concealment of their mode of procedure. Most of our readers remember well the case already mentioned of Redheffer's *perpetual motion,* as it was called; the question has been frequently asked from us, whether the mode in which he made his machine to go, has ever been discovered; we believe it has not, but we could construct a machine, as did Mr. Lukens, in external appearance and motion, like his, although we still could not aver that our mode of communicating motion would be the same with his, as we have conceived of more than one mode, and he, probably, had devised another. It was easy to show that it did not move from any of the causes assigned by him, or which were visible on its exterior.

Numerous as have been the contrivances to effect a perpetual motion, but few of them are placed upon record; a circumstance which is by no means surprising, as they have always ended in disappointing the hopes of their projectors. Those who pretend to have succeeded, have not informed us how we may do so, and are, therefore, not entitled to the slightest portion of credit. Almost the only machine of the kind which has obtained any celebrity, is the wheel of Orffyreus; of which an account was published by the celebrated philosopher, S'Gravesande, in the year 1774. This machine was in the form of a large circular wheel, or drum, 12 feet in diameter, and 14 inches in depth; the whole was very light, being formed of slats of pine, the intervals between which were closed, by being covered with waxed cloth, which served to conceal the interior parts. An iron axis upon which the wheel turned, rested upon two supports. On giving to this wheel a slight impulse, in either direction, its motion was gradually accelerated, until, in a few revolutions, it acquired a velocity of twenty-five, or twenty-six turns in a minute. It was placed in a room in the dwelling of the landgrave of Hesse, the door

being locked up, and sealed with the landgrave's seal, and for two months it continued this rapid revolution; at the end of which time it was stopped, to prevent the wear of the materials. S'Gravesande was an eye-witness of the whole operation, and made a critical examination of the external parts, which resulted in a conviction on his own mind, that there was no communication with any adjoining apartments. Orffyreus pretended to be so incensed at the curiosity of S'Gravesande, that he broke the machine in pieces, and wrote upon the wall, that it was the impertinent curiosity of the professor which induced him to take this step. The prince of Hesse, who had seen the interior of the wheel, declared that after it had been in motion for a considerable space of time, there was no appearance of any change in its parts; that there were no pieces which indicated fraud or deception, and that its construction was very simple. Orffyreus could never be prevailed upon to construct another.

This is all the information which we possess respecting this celebrated wheel, and it appears useless to offer any conjecture respecting the manner in which it was moved. It is highly probable, however, that the time had arrived when it suited Orffyreus to destroy it, to prevent detection and preserve his secret. When Redheffer had exhibited his machine for as great a length of time as he deemed it safe to do, he had it packed up for the purpose of sending it to Europe, in the care of two gentlemen with whom he had formed a connexion, and who were confident that it was a genuine self-moving machine. The war then existing prevented its being shipped; the principal of the two gentlemen alluded to, opened the case, and put the machine together, without the knowledge of Mr. Redheffer, when, lo, he found, to his utter astonishment, that the principle of motion had become extinct, and that the causes which had appeared to him sufficient to give it action, had, in reality, nothing to do with it. Mr. Redheffer was so incensed at the "impertinent curiosity" of the gentleman, who dared to open it before its arrival in Europe, that he refused to have any thing further to do with it. We apprehend that there is considerable parallelism between these two cases.

We have already made some remarks upon the preponderance of one end of a lever which has equal weights at each end, when the fulcrum is nearer to one end than to the other. Most persons are theoretically or practically acquainted with this fact, which depends upon a fundamental property of the lever; but it requires more knowledge, and a greater power of abstraction and analysis than most persons possess, to reduce a compound apparatus into its elements, particularly when its parts are constantly changing their relative positions, and their mutual actions are, consequently, varied. It may appear apposite to introduce, in this place, a description of the apparatus contrived by Desaguliers, in which two equal weights may be placed at any distance whatever from the centre of motion, and still continue in equilibrio. Fig. 1, in the plate, represents this instrument, A D denotes a balance with equal arms, and E F another of the same dimensions. These move on the centre B and C, and are connected by the inflexible rods A E and D F; the motion being left

free by means of joints at the corners. Across the rods A D, E F, are fixed two bars I K, L M. Now it is unnecessary to show that the weight G, will describe exactly the same line or circular arc, when the levers are moved into the position *a d f e*, or any other position, as it would have described in case it had been suspended at A, or K, or E; and that it is of no consequence in this respect at what part of the line A E, or I K, it be fixed. The same observations are true of the weight H, on the other side, and, accordingly, it is found, that these equal weights may be suspended any where on the lines I K, and L M, without altering their equilibrium.

By this contrivance, it is most evidently proved, to those who are totally unacquainted with the theory, that weights do not preponderate in compound engines, on account of their distance from the centre; and yet it is evident, upon a little reflection, that the fundamental proposition of the lever, or balance, remains uncontradicted; this proposition is, that equal bodies, at an equal distance from the fulcrum, will equipreponderate, but that at unequal distances, the most remote will descend.

Fig. 2. represents the most common form in which it has been attempted to make a self-acting machine. Hundreds, and probably thousands of models, have been made upon this plan, several have come under our own inspection, and, indeed, it appears to be the general stepping stone of those who begin the pursuit. We do not know that there is any earlier record of this plan, than that contained in the celebrated Bishop Wilkins's *Mathematical Magic*, published in the year 1684, although its antiquity, we have no doubt, is much greater. It is represented in that work, with sixteen loaded arms, but for the sake of simplicity, six only have been retained in the present drawing. Each lever, A, B, C, D, E, F, is moveable through an angle of 45°, by a joint near the circumference of the wheel, and the inner end or tail of each is confined by two studs or pins, so that it must either lie in the direction of a radius, or else in the required position of obliquity. If the wheel be now supposed to move in the direction E F, it is evident that the levers A, B, C, D, by hanging in the oblique position against the antecedent pins, will describe a less circle in the ascent, than when on the other side they come to descend in the positions E F; hence it was expected that the descending weights, having the advantage of a longer lever, would always preponderate. Dr. Wilkins, by referring the weights to a horizontal diameter, has, in this machine, shown that they will not. A popular notion of this result may also be gathered from the figure, where there are three weights on the ascending, and only two on the descending side; the obliquity of position on one side giving an advantage in point of number, equal to what the other may possess in intensity. Or if this contrivance were to be strictly examined, on the supposition that the levers and weights were indefinitely numerous, the question would be determined by showing that the circular arcs A K, H I, are in equilibrio with the arcs A G, G L.

The simplest method of examining any scheme of this kind with weights, consists in inquiring whether the perpendicular ascents and

descents would be performed with equal masses in equal times. If so, there will be no preponderance, and, consequently, no motion. This is clearly the case with the contrivance before us.

The marquis of Worcester, who will ever be remembered as the inventor of the steam engine, has described a perpetual motion in the 56th number of his Century of Inventions, published in the year 1655, and reprinted in this journal, Vol. 3d, p. 374. His words were as follow:

"To provide and make, that all the weights of the descending side of a wheel shall be perpetually further from the centre than those of the mounting side, and yet equal in number and heft to the one side as the other. A most incredible thing if not seen, but tried before the late king (of blessed memory) in the tower by my directions, two extraordinary ambassadors accompanying his majesty, and the Duke of Richmond and Duke Hamilton, with most of the court attending him. The wheel was 14 feet over, and 40 weights of 50 pounds a piece. Sir William Balfour, then lieutenant of the Tower, can justify it with several others. They all saw, that no sooner these great weights passed the diameter line of the lower side, but they hung a foot further from the centre; nor no sooner passed the diameter line of the upper side, but they hung a foot nearer. Be pleased to judge the consequence."

Desaguliers, in his course of experimental philosophy, Vol. 1, p. 185, has quoted this passage, and given a sketch of a pretended self-moving wheel, similar to that of Fig. 3, as resembling the contrivance mentioned by the marquis of Worcester. The description of the last engineer agrees, however, somewhat better with the contrivance Fig. 2. It must, of course, be a mistake in terms, when he says the weight receded from the centre at the lower diameter, and approached towards it at the upper: the contrary being, in fact, necessary to afford any hope of success; and, accordingly, in the quotation it is so stated.

Mr. Nicholson is of opinion, that the wheel of Orffyreus was constructed in the manner represented in Fig. 3, and that it, probably, was made to revolve, during the time of exhibition, by some concealed apparatus. This represents a number of cells or partitions, distinguished by the letters of the alphabet, which are made between the interior and exterior surfaces of two concentric cylinders. The partitions being placed obliquely with respect to the radius, and a cylindrical or spherical weight placed on each, it is seen from the figure, that these weights will lie against the inner surface of the large cylinder, whenever the outer end of the bottom partition of any cell is lowest; and on the contrary, when that extremity is highest, the weight will rest on the surface of the interior cylinder. Let the wheel be made to revolve in the direction A, B, C; the weights in C, D, E, F, G, H, I, being close to the external circle, and the weights K, L, M, A, B, close to the inner, for the reasons last mentioned. As the cell B descends, its weight will likewise run out, at the same time that the weight in the cell I will run in, in consequence of its partition being elevated. By the continuation of this process, since

all the weights on the descending side pass down at a greater distance from the centre, while those on the ascending side rise for a considerable part of their ascent at a less distance from the same point, it is concluded that the wheel will continue to retain its motion. On this, however, it is to be remarked, that the perpendicular ascent and descent are alike, both in measure, and in time of performance, and that the familiar examination, even to those who know little of such subjects, is sufficient to show that the preponderance is not quite so palpable as it at first appears. For the weights G and F, H and E, I and D, are evidently in equilibrio, because at the same horizontal distance from the centre; and if the favourable supposition that the weight B has already run out, be admitted, it will then remain a question whether these two exterior weights, B and C, can preponderate over the four inner weights K, L, M, A. The more accurate examination of this particular contrivance, will lead to the following theorem. In two concentric circles, if tangents be drawn at the extreme points of a diameter of the smaller, and continued till they intersect the larger, the common centre of gravity of the arc of the greater circle included between the tangents, and of the half periphery of the smaller circle on the opposite side of the diameter, will be the common centre of the circles.

If, therefore, the balls were indefinitely numerous and small, the supposed effective part of the wheel, Fig. 3, would be in equilibrio, as well as the parts beneath the horizontal tangent of the inner circle.

Fig. 4, represents a small wheel, or hollow ring, with hollow projecting spokes, into which a quantity of quicksilver is poured. Small bellows are fixed on the end of each spoke, so that the mercury may run into them, through the tube; the moveable board of each bellows has a weight attached to it, as seen in the drawing. The weights on the ascending side operate to close, and those on the descending side to open the bellows; it is thus intended to force the mercury from the former into the latter. There is no difficulty whatever, in perceiving that we have here only substituted a fluid for the balls and weights in Figs. 2 and 3, and the same theoretical objections will apply in each case.

Fig. 5 is the plan of a machine for which a patent was obtained by Dr. Shivers, in England, in the year 1790, and which, it was pretended, continued in motion for several months together. There, however, is not the smallest probability that it would continue in motion for half a minute, or nearly as long as a simple wheel would retain part of its first impulse.

In the drawing of this machine, the external circle denotes a wheel carrying a number of buckets, A, B, I, L, &c. C represents a toothed wheel, on the same axis, which drives a pinion D; and this last drives another pinion E upon the axis of a lanthorn, or wheel intended to work a chain pump with the same number of buckets as in the large wheel A, B, I. The lanthorn G, is made of such a size as to raise the buckets *a*, *b*, *i*, *l*, with a due velocity. K represents a gutter, through which a metallic ball, contained in the bucket *m*, may run and lodge itself in the bucket A of the wheel. Each of the buckets of the wheel B, I, L, M, which are below the gutter, is sup-

plied with a metallic ball, and so, likewise, are the ascending buckets *a*, *b*, *i*, *l*, *m* of the chain-pump. As the pump supplies the wheel, it is itself again supplied at M, where the balls fall into its ascending buckets. Now, it is presumed, that the balls in the wheel, I suppose on account of their distance from the centre of motion, will descend with more than sufficient force to raise those on the chain, and, consequently, that the motion will be perpetual.

The deception in this contrivance, has much less seduction than in either of the three preceding, because it is more easily referred to the simple lever. It may readily be seen by those who have any knowledge of mechanics, and particularly of wheel work, that whatever is gained by the excess of the diameter of the great wheel, beyond that of the wheel C, is again lost by the excess of the lanthorn G beyond the pinion E.

A large portion of the foregoing description has been taken from an article on the same subject in the quarto series of Nicholson's journal, as it appeared well calculated for our purpose. Some portions of it we should have attempted to render more familiar, had not other avocations interfered.

The simplest rule that we can give, by which to perceive the fallacy of every plan depending upon the ascent and descent of weights, is, that whatever may be the weight which descends in a given time, it must raise an equal portion of matter to the same perpendicular height, in the same time, or the machine must evidently stop; now the power required to raise any weight to a given height is the same, provided the time be the same, whether that weight be raised vertically, or obliquely. If the weights, the balls, or the mercury are to descend, they must first ascend to the necessary height; an equilibrium must, therefore, soon take place, should motion be produced by any extraneous force. Putting friction and a resisting medium out of the question, these machines supply no source of motion even to themselves.

It is not intended to be denied, that there are in nature, agents, or powers, which we may employ to keep machines of various kinds in constant action, whilst the materials of which they are composed, will endure; but this would not constitute a mechanical perpetual motion; according to our understanding of the term, the motion must be produced by an unvarying energy in matter, resulting from its inherent properties, such as its gravity. Not only is the whole system of the universe in motion, but upon the surface of our earth the various particles of which its materials are composed, are perpetually moving amongst themselves; some of these motions are perceived by their effects, only after a considerable lapse of time, or by the aid of delicate instruments; whilst others are readily perceived by the senses, in consequence of the rapidity with which they are effected. Some of these may be employed to keep clocks, and other engines wound up so that their action shall be continued. The contractions and expansions of a long bar of metal, from changes of temperature, the rise and fall of mercury in the barometer, the perpetual current of rivers, the flux and reflux of the tide, regular and irregular winds,

and drafts, or currents of air, the hygrometric changes in certain substances, are of the kind intended; the employment of some of them is familiar, and the possibility of using the whole of them, as well as some others which have not been enumerated, will be evident to most of our readers.

The galvanic action produced by the contact of certain bodies, as in the electrical columns of Zamboni, De Luc, and others, has, for several successive years, kept a pendulous body in vibration, so as to strike bells, and cause them to ring; and we think it highly probable that means may yet be discovered for obtaining a similar action from the magnetic influence. The intimate connexion between heat, light, electricity, and magnetism, which has been pointed out by the novel and curious discoveries on *electro-magnetism*, serves to give additional probability to such a conjecture; but should we succeed in the development and direction of these powers with undiminished energy, so as to produce a continued and sensible motion in any body, or system of bodies, we should be no nearer to the solution of the problem of a mechanical perpetual motion, than we are at present; and it would require no small degree of hardihood in any one to assert that we have yet advanced a single step in the inquiry, by all the labour and thought which numerous ingenious individuals have given to the subject.

On the blowing of Air into Furnaces, by a Fall of Water. By the late William Lewis, M. D.

(Concluded from page 80.)

I have received an account from a worthy correspondent in Switzerland, of a machine which he has constructed for a smelting furnace according to the foregoing directions : he says, it has so much the advantage of all other kinds of bellows, that it deserves to be introduced universally wherever the situation of the place will permit. The only inconvenience he finds in it is, that the colander and gratings are liable to be stopped up with leaves, &c. With regard to the colander, the obstruction may be obviated by enlarging the holes. The gratings ought to be of a large surface : the wire grating in the cistern on the top may be a cylinder, nearly as large as the cistern will receive, for if it is no more than sufficient to cover the mouth of the pipe, it will doubtless be found choked up. When so much of the cylinder becomes stopped, that the water has no longer a free passage through, it may be lifted up and cleaned, another being placed in the room of it, without the trouble of turning off the water, or interrupting the going of the machine. The gratings here can be liable to no other inconveniences than those which are common in other water-machines, mills, aqueducts, &c.

Some further improvements have occurred in the construction of these machines, by which they may be made effectual, in cases when the quantity of fall of water would otherwise be insufficient.

Of constructing Blowing-Machines, with Falls of Water of great height.

Where the height of the fall is great, the quantity of water is usually small; and in all the ways of application that have hitherto been contrived, the height will by no means make amends for the deficiency in quantity.

In the common construction of these machines, where the upper pipe, or funnel, is no more than three, four, or five feet high; though the fall should be such as to admit of the lower pipe being thirty or forty feet or more, it does not appear that any material advantages could result from such a height. For, as the air is admitted into the water only at the top of this long pipe, it cannot, I think, be supposed that the quantity admitted will be the greater for the length of the passage under the place of its admission. Water indeed has been found by Marriotte to run faster through an upright long pipe than through a short one: a quantity of water which was forty-five seconds in running through a pipe three feet long, was discharged in thirty-seven seconds, or near a sixth part less time, through a pipe of the same bore, and a double length; so that, as more water passes successively through a long pipe than through a short one, in equal times, more air also must be carried down by it. But in the case which we are here considering, no benefit can be expected on this principle; for as the supply of water is supposed to be limited, the bore of the pipe must necessarily be made less, in proportion to the increase which its length may produce in the velocity. If the lower pipe is of such a height that the watery column it contains may sufficiently resist the force of the air in the air-vessel, it should seem that any further addition to its height could be of no manner of use.

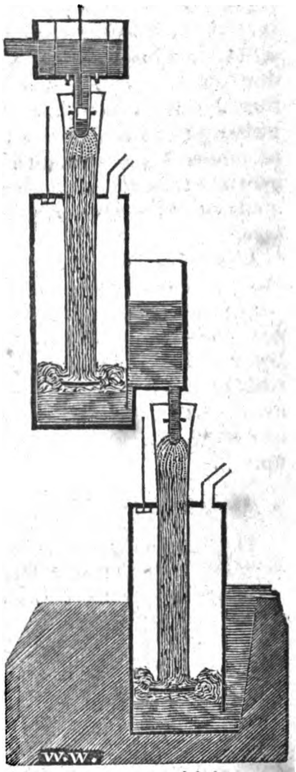
We have seen, in the foregoing part of this essay, that it would be more adviseable in such cases to shorten the lower pipe, and to lengthen the upper one: by this means the water, acquiring greater velocity at the place of its discharge from the upper pipe into the lower, is enabled to divide or spread more, and thus to receive more air into its interstices. The advantage thus obtained does not, however, increase in so great a proportion as the height does. From an experiment above related, it appears, that by increasing the height four-fold, the effect was not increased three-fold; and this even in small heights, where the effect is much more influenced by a variation in height than it is in great ones.

The observations already mentioned, point out the means of availing ourselves more advantageously of high falls, so as to produce always, with certainty, from a fall of a double or treble height, a double or treble effect, if the quantity of water be the same; or an equal effect, with one-half, or one-third, the quantity of water.

Experiments have convinced me that a fall of fourteen feet is more than sufficient for compressing the air to such a degree as to be able to sustain the gauge to the height of four feet; or to raise, on an opening of a square inch, a weight of about a pound and three-quarters avoirdupois, or above two pounds troy; a compressure which is

apprehended to be as great as there will in general be occasion for. Where we have plenty of water with such a fall, we can drive in air, with this force, in any quantity: for if one machine, with a certain portion of the stream, produces a continued blast of this strength, through a pipe of a certain bore, as an inch, or three-quarters of an inch, it is evident that the quantity of air may be doubled, trebled, &c. at pleasure, without diminishing the compressure or force of the blast, by adding another and another machine, till all the stream is employed. It is plain, in like manner, that the same advantage may be received from high falls, by placing one machine over another; that after the water has performed its office in falling through one machine, it is still capable of exerting the same action in another and another machine, so long as equal spaces remain for it to fall through; so that the total effect must be the same as if a quantity of water, sufficient for working all the machines, came at first in one stream.

Fig. 1.



A natural fall of water of twenty-eight feet, formed into two artificial ones of eighteen feet each, is represented in Fig. 1. This double machine may be presumed to have twice the effect of a single one, in virtue of this division; besides the advantage of the more free admission of air, and the spreading of the stream through a pipe of a much larger bore, by which it is enabled to carry down in its interstices a much greater quantity of air. The two vertical lines in the upper reservoir represent a cylindrical grating of iron wire, to keep back weeds, &c. The division of the air-vessel, and the course of the water from the upper machine to the lower, are apparent from the figure.

In the lower machine, whose air-vessel is sunk to a considerable depth in a pit made in the ground, the water is forced up in the pit, on the outside of the vessel, four feet higher than the surface of the water within the vessel; or of the stone on which the water dashes, called by the workmen the dash-board. The air-vessel of the upper machine having an additional part at one side, which performs the same office as the pit, the water is in like manner forced up to the same height in this outer part; which outer part serving as a reservoir for the machine under it, the water begins to act in this lower machine four feet higher up than the dash-board of the first. Whatever number of machines the fall will admit of,

the case is the same in them all: though in each of them the water falls eighteen feet, yet as it is pressed up again four feet for the succeeding machine, one machine takes up but fourteen of the real fall.

The outer vessel, and its communication with the air-vessel, may be conveniently formed by an upright partition in the air-vessel itself not reaching quite to the bottom. The outer division may be open at top, and need not be so high as the close air-vessel; it is fully sufficient if it reaches a little more than four feet above the level of the dash-board, the water which it is designed to receive not rising higher than this. In other respects, the structure of these machines agrees entirely with that of the single ones already described. It must be observed only, that the colanders of the lower machines should be, as nearly as possible, of the same dimensions with those of the upper ones. For if they are of smaller bores, they will not admit of all the water which passes through the upper ones, so that part of it must run to waste; if they are larger, the water will pass off too fast, without producing its due effect. The regulators before described are here particularly useful, affording ready means of increasing or diminishing the apertures in the colanders occasionally while the machines are at work.

Fig. 2.

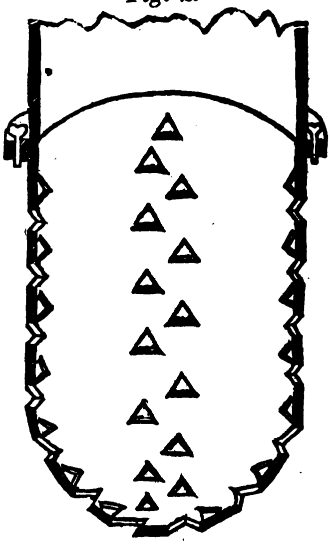


Fig. 2 is a prospective view of the colander, screwed to the upper pipe, drawn to a larger scale, to show the disposition of the holes. The holes may be made wider than formerly proposed, as an inch each side, to prevent any danger of their being choked up.

Of Blowing Machines, with low falls of Water.

The dimensions hitherto given are such as appear the most advantageous. Much lower falls, however, than those which the foregoing machines are calculated for, as ten, eight, or perhaps seven feet, may be made to afford a strong blast. To produce such a compressure of the air in the air-vessel, as to raise the gauge four feet, a fall of about six feet is necessary for the lower pipe. If the upper pipe is only about a foot and a half or two feet, the water, when divided by means of the colander, will carry down a certain quantity of air; and though the quantity, from an equal stream of water, will not be so great as when the fall is higher, yet, as there are in many parts of the kingdom large bodies of water running with such a descent, the deficiency may be compensated, as already noticed, by enlarging or multiplying the machines.

For many purposes, still less falls will suffice. The smith's bellows, as we have formerly seen, raises the gauge only about fourteen inches; and such a compressure, it is presumed, may be gained from a fall of five feet or less. Small falls may be applied also to another purpose, of no little importance, *the ventilation of mines and coal-pits*, or the driving in of fresh air, in the room of that which the mineral vapours have rendered unwholesome or pernicious.

In all these machines, it must be observed, that the height of the column of water falling through the pipe, determines not the actual force of the blast, but the greatest force which can be given it in that machine: that the height of the gauge is always the measure of the actual force; that this force depends on the width of the pipe through which the air is discharged from the air-vessel, and may be diminished or increased in any degree up to the greatest that the column of water can resist, by widening or narrowing the aperture of the pipe; that different machines will give blasts of equal force through pipes of greater or less width, according to the greater or lesser quantities of air which the water carries down with it; and that, therefore, the size of the blast-pipe must be adjusted by trial, for each particular machine.

The distance of the dash-board under the pipe may likewise admit of some variation, and require to be regulated according to the size of the pipe. In some of the common machines this distance is three or four feet, or more; but so large a space is apparently a disadvantage; for so much of it as is more than sufficient for the free passing off the water is entirely useless, being, in effect, so much taken off from the height of the fall. The distance of six inches, laid down in the foregoing machines, is designed for a circular pipe of twelve inches diameter; in which case the area, by which the water is discharged all round, is just double to the area of the pipe, and consequently more than large enough for letting the water off without impediment.

AMERICAN PATENTS.

Numerous applications are made at the Patent Office for information respecting the mode of taking out patents, and the tenure by which they are held; to answer these inquiries the subjoined directions have been drawn up, and printed for distribution. The points which have been noticed, are those to which these inquiries ordinarily relate; and it will be seen by those who have been attentive readers of this Journal, that for much of the information given, the editor is indebted to the essays on the patent laws, written by his friend P. A. Browne, Esq.; it is indeed from an attentive study of these excellent essays, that he has derived a large portion of the knowledge which he possesses of the actual operation of the patent laws of this country, and of England.

Information to Persons applying for Patents, or transacting other business at the Patent Office.

Department of State—Patent Office.

The Acts of Congress which relate particularly to the granting of Patents for inventions and improvements, are two in number; the first was passed February 21st, 1793; and the second, on the 17th of April, 1800.

The persons who have a right to take out patents, are all citizens of the United States; and aliens who have resided therein for two years. In other cases they can be obtained only by a special act of the national legislature.

Joint inventors may take out a joint patent, and where two or more persons have concurred in perfecting any invention or discovery, it would seem necessary that they should also concur in taking out a patent, as neither of them can justly claim to be the sole inventor.

In case of the decease of an inventor, who has not taken out a patent for his invention, it may be obtained by "the legal representatives of such person, in trust for the heirs at law of the deceased, in case he shall have died intestate; but if otherwise, then in trust for his devisees." "And when application for a patent shall be made by such legal representatives, the oath, or affirmation," &c. "shall be so varied as to be applicable to them." (Act of 1800, sec. 2.)

The term for which a patent is granted, is fourteen years: a patent cannot be renewed at the expiration of this term, excepting by a special act of Congress.

The things for which a patent may be obtained, are, "any new and useful art, machine, manufacture, or composition of matter, or any new and useful improvement on any art, machine, manufacture, or composition of matter, not known or used before the application." (Act of 1793, sec. 1.)

The thing patented must be new. "Every inventor before he can receive a patent, shall swear, or affirm, that he does verily believe that he is the true inventor, or discoverer of the art, machine, or improvement, for which he solicits a patent." (Act of 1793, sec. 3.) In the case of a resident alien, it is required, that he declare on oath, or affirmation, in addition to what is required from a citizen, "that the same hath not, to the best of his or her knowledge or belief, *been known or used in this or in any foreign country.*" (Act of 1800, sec. 1.) It thus appears that an alien is restricted from taking out a patent although he may be "the true and original inventor or discoverer," provided the thing has "been known, or used, in this or any foreign country."

ON THE FORMS, AND MANNER OF PROCEDURE, NECESSARY IN APPLYING FOR A PATENT.

The method of applying for a patent is by petition, addressed to the Secretary of State, which is usually in the following form:

To A. B. Secretary of State of the United States:

The petition of C. D. of ———, *in the county of* ———, *and state of* ———, *respectfully represents—*

That your petitioner has invented a new and useful improvement in [the machine for cutting and heading nails at one operation,] *which has not been heretofore used or known, the advantages of which he is desirous of securing to himself and his legal representatives; he therefore prays that letters patent of the United States may be issued, granting unto your petitioner, his heirs, administrators, or assigns, the full and exclusive right of making, constructing, using, and vending to others to be used, his said improvement* (art, invention, machine, manufacture, or composition of matter, etc.) *agreeably to the acts of Congress in such case made and provided; your petitioner having paid thirty dollars into the treasury of the United States, and complied with other provisions of the said acts.*

C. D.

THE DESCRIPTION OR SPECIFICATION.

Accompanying the petition there must be a description, or, as it is usually termed, a specification of the thing intended to be patented; the words of the law are as follows, "and shall deliver a written description of his invention, and of the manner of using, or process of compounding the same, in such full, clear, and exact terms, as to distinguish the same from all other things before known, and to enable any person skilled in the art or science of which it is a branch, or with which it is most nearly connected, to make, compound, and use the same. And in the case of any machine, he shall fully explain the principle, and the several modes in which he has contemplated the application of that principle, or character, by which it may be distinguished from other inventions." (Act of 1793, sec. 3.)

The following form may be used for the preamble of the description, or specification:

To all to whom these presents shall come:

Be it known, that I, C. D. of ———, *in the county of* ———, *and state of* ———, *have invented a new and useful improvement in* [the machine for cutting and heading nails at one operation,] *and that the following is a full and exact description of the construction and operation of the said machine, as invented or improved by me.*

Here follows the description of "the art, machine, manufacture, or composition of matter." It is scarcely necessary to observe, that the phraseology of the specification must be such as to correspond with the nature of the thing patented, whether it be an *art, machine, or composition of matter;* by which last term is intended, what is usually called a *compound,* the recipe for which is to be given in the specification.

The necessity of the most particular attention to the requirements of the law, in drawing up the specification, cannot be too forcibly urged upon those who apply for patents. A number of those which have

undergone judicial investigation, have been vacated in consequence of some defect in the matter or form of this instrument: it is, in fact, upon the averments of the specification that the validity of the patent must, in almost every instance, be decided. Many specifications which are deposited in this office, evince not only an ignorance of the laws regulating the granting of patents, and the decisions which have taken place under them, but also manifest a deficiency of that knowledge in mechanics, and the arts, which is necessary to an accurate and clear description of a machine, or process, and without which a patent must be evidently insecure; all that can be now offered, are a few directions embracing those points which appear to be of the most importance.

A patent is to be considered as a contract between the patentee, and the public: the former is to make known in *full, clear, and exact* terms, the nature of his invention, or discovery, so as to enable a person skilled in the art, to practise it, from this description: the latter, on condition of this being done, secures to the patentee, the exclusive right to use and dispose of his invention or discovery, for the term of fourteen years, in consideration of which it is afterwards to become public property. The necessity, therefore, of observing the following rules will be apparent.

In making the description, no part of the invention may be omitted, the whole must be described.

The whole process is to be made known; a less perfect mode of proceeding must not be inserted whilst a more perfect one is known to, and practised by, the patentee.

It is not sufficient, that the whole machine, process, or compound be given; if there be added any part, or ingredient, calculated to defeat the process, and intended to deceive the public, the patent is not good.

No more must be claimed in the patent, than what is new, and is the invention, or discovery, of the patentee.

Many patents have been vacated, in consequence of inattention to this last rule. In the specification it is perfectly proper to describe an entire machine, although most parts of it may have been long known and used, as, otherwise, it may be difficult to make known the improvements; but after doing this, the patentee should distinctly set forth what he claims as new; and this is best done in a separate paragraph, at the end of the specification; which may commence in a form something like the following:

What I claim as new, and as my own invention or discovery, in the above described machine, [art, manufacture, or composition of matter,] *and for the use of which I ask an exclusive privilege, is, &c. &c.*

Where the machine or instrument is old, but is applied to an entirely new purpose, this fact must be stated; as the patent in this case cannot be for the instrument, but must be for the application of it only.

Where a patent is taken for an improvement upon a machine previously patented by some other person, the right to use the original

invention must be obtained from the first patentee; nor can he use the improvement without the consent of the improver.

"*And be it further enacted*, That any person who shall have discovered an improvement in the principle of any machine, or in the process of any composition of matter, which shall have been patented, and shall have obtained a patent for such improvement, he shall not be at liberty to make use of, or vend, the original discovery,* nor shall the first inventor be at liberty to use the improvement: and it is hereby enacted and declared, that simply changing the form or proportions of any machine, or composition of matter, in any degree, shall not be deemed a discovery." (Act of 1793, sec. 2.)

When an inventor obtains a patent for an improvement upon an article previously patented by himself, the right to the first article, (a machine for example) will become public at the end of the term for which the first patent was taken. The improvement cannot have the effect of renewing the original grant.

The specification must be signed by the applicant, in the presence of two subscribing witnesses.

OF THE OATH OR AFFIRMATION.

Subjoined to the specification, there must be an oath, or affirmation, administered by some duly qualified person. This, when the applicant is a citizen, may be in the following form:

County of ——, }
State of ——, } *ss.*

On this —— *day of* ——, 18—, *before the subscriber, a justice of the peace, in and for the said county, personally appeared the aforenamed C. D. and made solemn oath* [or affirmation] *according to law, that he verily believes himself to be the true and original inventor, or discoverer, of the machine* (art, invention, or improvement, composition of matter, etc.) *above specified and described for* [cutting and heading nails at one operation;] *and that he is a citizen of the United States.*

—— ——, *Just. Peace.*

If not a citizen (or citizens,) to the oath or affirmation that he verily believes himself to be the true and original inventor or discoverer of the machine, etc., the following addition must be made; "*and that the same hath not, to the best of his* [or her] *knowledge or belief, been known or used either in this or in any foreign country: and that he* [or she] *hath resided in the United States for two years.*"

Every application for a patent will thus consist of three distinct instruments of writing: the petition, the specification, and the oath, or affirmation. The petition ought to state in clear, but concise terms, the nature, or object of the improvement, &c. for which a patent is claimed; in the specification the invention or discovery should be fully and completely described; and this, in its words and tenor, should agree with the object concisely stated in the petition; and the oath or affirmation ought also to correspond with the preceding instruments.

OF DRAWINGS, MODELS, AND SPECIMENS OF INGREDIENTS.

The law declares that the patentee "shall accompany the whole with drawings, and written references, where the nature of the case admits of drawings." (Act of 1793, sec. 3.) Great difficulty has been sometimes experienced in preparing specifications, from a prevailing idea, that it is necessary to describe a machine *in words*, without any reference being made to the drawing, in the body of the instrument. Neither the words of the law, or the practice of the office, lend any aid to this opinion. References to the drawing may be made throughout, and in most instances the description may be much shortened by so doing; observing that whenever references to the drawings are made in the specification, two copies of these drawings must be forwarded, one of which will be returned, attached to the patent, and the other retained in this office.

The drawings ought, in general, to be in perspective; and these should be accompanied by representations in section, or in detail, of such parts as may not otherwise be clearly understood.

They should be well executed, and rarely need exceed the size of a page of letter paper.

A model will, hereafter, be required in all cases where it is believed that the nature of the machine will be more clearly shown by it, than by drawings alone. The law says, "and such inventor shall moreover deliver a model of his machine, provided the Secretary shall deem such model to be necessary." (Act of 1793, sec. 3.) These models should be neatly made, and as small as a distinct representation will admit; they ought to have a permanent label affixed to them, by engraving, painting, or otherwise. They will be carefully kept, for the advantage of the patentee, and the information of the public.

When the invention is a *composition of matter*, the law requires that specimens of the ingredients shall be deposited: the words are, "or with specimens of the ingredients, and of the composition of matter, sufficient in quantity for the purpose of experiment, where the invention is a composition of matter." (Act of 1793, sec. 3.)

OF INTERFERING APPLICATIONS.

Requests are frequently sent to this office, that patents may not be granted, or that, in certain cases, they may be delayed; these requests are founded in a very prevailing, but erroneous opinion, that there is such a judicial or discretionary power, vested in this department. In the United States, the patent is a *constitutional right*, which the citizen, or the qualified alien, may demand, and which the officers of government have no power to withhold. Should a patent issue to an individual to-day, another person who shall have complied with all the requirements of the law, may to-morrow, obtain a patent for the same thing. The validity, in either case, is a question for a court and jury to decide. The patent secures to the patentee, the exclusive right to *his own* invention, or discovery; but it confers no right to the thing patented, where he is unable to sus-

tain the allegation, "that he has invented a *new* and *useful* art, machine, manufacture, or composition of matter;" "or a *new* and *useful* improvement," &c. (Act of 1793, sec. 1.)

When there are two applicants at the same time, for a similar patent, the law has provided for the appointment of three arbitrators, one by each party, and one by the Secretary of State. Where there are more than two applicants, and they do not concur in the appointment of arbitrators, the whole may be appointed by the Secretary of State, and their award is "final as respects the granting of the patent." (Act of 1793, sec. 9.) This, however, does not render the patent valid, as the question of its validity may afterwards be examined in a court of law.

In order to justify a reference, it has been determined, that each party must have complied with all the legal requirements; that is, they must each have paid thirty dollars into the treasury, and their papers have been regularly filed. As this rarely occurs, the remedy sought, is, in general, that pointed out in the 10th sec. of the Act of 1793, which provides, that "within three years after issuing the patent, upon an oath or affirmation being made before the judge of the district court, where the patentee, his executors, administrators, or assigns, reside, that the patent was obtained *surreptitiously*, or upon *false suggestion*, the court, upon motion made, if the matter alleged appears to be sufficient, may grant rule to show cause why process shall not issue to repeal the patent."

FEES PAYABLE IN THE PATENT OFFICE.

The first step, in applying for a patent, is the payment of thirty dollars; "every inventor, before he presents his petition to the Secretary of State, signifying his desire of obtaining a patent, shall pay into the Treasury, $30, and the money thus paid shall be in full for the sundry services to be performed in the Office of the Secretary of State." (Sec. 11, Law of 1793.)

For copies of patents, or parts thereof, there is a charge of 20 cents for every 100 words; and the legal allowance for copying a drawing, is $2. The actual charge is frequently less than this, but in many instances, the drawings are so complex that they cannot be executed for this sum.

The average expense of recording a transfer is about one dollar; the fees being the same as for copies of patents.

For certified copies of patents there is an extra charge of 25 cents, but these are furnished in litigated cases only, to be used as evidence. All payments must be made previously to the delivery of the papers to the applicant.

OF A CAVEAT.

Caveats are not known in law. There is a prevalent, but erroneous idea, that a *caveat* may be entered, which will secure the right for a certain time. It is the practice of the Office to put on file, such accounts of inventions or discoveries, as may be forwarded for that purpose;—these are not exhibited to others, but may be used as evidence when required by the depositor. It is also the practice to

inform him, should a similar application be made. This, however, is not to be expected, excepting in recent cases, as such descriptions are not recorded, and the number on file renders a general examination impracticable.

TRANSFER OF A PATENTEE'S RIGHT.

An inventor may transfer his right before a patent has issued, and the assignee may take out a patent; or he may obtain his patent, and afterwards assign it. The assignment, in either case, must be recorded in the Patent Office. (Act of 1793, sec. 4.)

Those applicants for patents who are desirous of having them issue immediately, may have this done by sending on two complete sets of papers, neatly written; in this case, one copy of the specification should be upon parchment, of the size of foolscap paper, opened out; or it may be written upon such paper, of a strong texture.

All communications to, and from, the Superintendent of the Patent Office are free of postage; the petition to the Secretary of State; the fees to be paid into the Treasury; and all other matters on the subject of patents, may be addressed, directly, to this office; and all business relating to patents, may, in general, be as well done by writing, as by a journey to Washington.

When models are demanded, a reasonable time for forwarding them, is allowed to applicants who live in remote situations, and the patent is issued, upon a bond being given providing that the model shall be delivered at the office within a time specified.

Those who are unable to obtain good drawings at home, may have them executed at Washington, by persons unconnected with the office. In some cases, a rough sketch, and in all, a good model, will serve as a guide. Care will be taken that the charges shall be moderate. THOMAS P. JONES, *Superintendent.*

LIST OF AMERICAN PATENTS GRANTED IN SEPTEMBER, 1828.

With Remarks and Exemplifications by the Editor.

1. Improvement in the construction, manufacture, and management of the *Bobbins and Flyers for spinning cotton;* Charles Danforth, Ramapo, Rockland county, New York, September 2.

As soon as some anticipated improvements are completed, the whole will be presented to our readers. The patentee does not yet consider his system as perfect, and, therefore, wishes the publication delayed.

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2. Improved machine for *Washing all kinds of wearing ap-*

parel, &c.; Jonathan R. Davis, Hartland, Niagara county, New York, September 2.

This machine has a wash-board, very similar to that which has been so extensively used in this country, having grooves across it, upon which the clothes are rubbed by hand, instead of being rubbed between the hands. The present patentee adds a grooved roller, which is to be fixed in a suitable frame; the clothes, &c. to be washed, are laid upon the grooved board, where they may be kept moistened with soap-suds, and the grooved roller is passed backward and forward over them, the frame in which it revolves being held in, and guided by, the hand; there are, also, grooved guides on the frame, which work on projecting strips on the edge of the wash-board, to retain the roller and frame in their places..

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3. *A Fire and water proof cement;* James Coburn, Middlesex county, Mass. Sept. 3.

This is one of those specifications which, for the interest of the patentee, we have concluded not to publish.

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4. *A Socket vice;* Luther Hemminway, Sullivan, Cheshire county, New Hampshire, Sept. 4.

(See the specification.)

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5. An improvement in the *Machine for washing cloths;* Joseph Hathaway and Rufus Hathaway: the former of Pultney, Steuben county; the latter of Canandaigua, Ontario county, New York, September 5.

This machine consists of two hollow cylinders. The outside cylinder is fixed in a suitable frame, its axis being horizontal. This cylinder is made water-tight, and is divided into two parts, the lower half forming a trough, and the upper half a cover or lid. Within this cylinder, another is made to revolve, by means of a crank and gudgeons. The circumference of the inner cylinder, is formed by slats, dove-tailed into the circular ends, and standing about three-quarters of an inch apart. Into this, the cloth to be washed is put, there being a door for that purpose. The slats are sloped on the sides in reversed directions, so that when the inner cylinder is turned either way by the crank, the water shall have a tendency to flow from the outer into the inner cylinder. The motion proposed to be given, is a vibratory one, by turning the crank each way, about half a revolution. On two opposite slats, pins are placed, pointing towards the centre of the cylinder; these are intended to change the position of the cloth to be washed. The frame is to be kept together, and tightened, by iron rods with heads, screws, and nuts.

This machine, in its general features, bears a strong resemblance to others which have been heretofore used; the patentees say, " what we claim as new, and as our own invention, in the above described machine, is the operation of the open cylinder, and the manner of

fixing in those slanting slats, to carry the water to every part of the machine, to serve as drenchers; also the iron rods that fasten the frame together."

6. An improvement in the *Mill for grinding corn*, or other grain; Reuben Medley, Bloomfield, Nelson county, Kentucky, September 5.

The main object of this invention appears to be the turning of both mill stones in opposite directions; as this is not new, the claim of the patentee must rest upon the manner of effecting this object. A vertical wheel, with cogs upon its face, works into two vertical trundles at its upper and lower points, and, of course, turns them in opposite directions. These trundles are attached to the spindles of the upper and lower stones, and the desired motion is thus attained. The manner of attaching the spindles, and hanging the stones, we do not think it necessary to describe. The patentee says, "what I claim as new, and as my invention, or discovery, in the above described grist mill, is the use, or application of the whole machine, with the exception of the two main wheels, and the wallower in the horse mill."

7. An improvement in the *Mill for grinding and manufacturing all kinds of grain* into meal and flour; James Smith, and William Sapp, Mount Vernon, Knox county, Ohio, September 9.

(See specification.)

SPECIFICATIONS OF AMERICAN PATENTS.

Specification of a patent for a Socket Vice. Granted to LUTHER HEMMINWAY, *of Sullivan, Cheshire county, New Hampshire, September* 4, 1828.

THE socket vice may be made of any size, according to the use to which it is to be applied, and of metal or wood. When made to be used as a socket for awls, it should be of steel; its whole length should be about two inches and three-fourths; one end, for about three-fourths of an inch, should be round, and about one-fourth of an inch in diameter; beginning three-eighths of an inch from the end, it should taper slightly to the end, upon which, for the same distance, a screw should be cut; it should then diminish, and again increase in diameter, in both cases slightly, and gradually; at three-fourths of an inch from the end it is flattened abruptly, forming a shoulder on two sides, and is made tapering on the two edges, to the other end, where it is pointed; a hole is made longitudinally into the round end, about three-fourths of an inch deep; it is then cut twice transversely from the end to the bottom of the hole, dividing it into four equal parts; a hollow screw or nut, adapted to the vice, is screwed upon this end, compressing it so as to hold, firmly, the shank of the awl; the outside

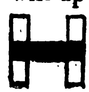
shape of the nut should be square, so that it may, by means of a small wrench, be easily screwed on or off. The pointed end of the socket vice, may be inserted in a handle of wood, so far as to the commencement of the screw. When made for other uses, the size and the form of the shank may be varied, to suit such uses.

LUTHER HEMMINWAY.

Specification of a patent for an improvement in the Mill for grinding and manufacturing all kinds of grain into Meal and Flour. Granted to JAMES SMITH, *and* WILLIAM SAPP, *of Mount Vernon, Knox county, Ohio, Sept. 9th,* 1828.

THE following is a full and exact description of the construction and operation of the improvement made by us. A husk, together with a bray-board, bridge-tree, lighter iron and staff, are made after the usual manner, or on the plans laid down by the writers on mill-wright work, with the exceptions stated.

The bridge-tree may be raised or lowered by means of a screw and nut, or a screw and windlass, or, as in the usual manner, by a lighter strap and weight, at the discretion of the constructor. An iron spindle with a hardened steel foot is placed in an iron or steel step (as are already in constant use) and rises above the foot of the spindle (at the discretion of the constructor;) a whirl, pulley or trundle head (at the like discretion) is fastened on the spindle, by means of which the spindle is turned, by a strap, or by gearing, as in other mills in long and common use. Across the top of the husk, and parallel with the bridge-tree, are two pieces of timber, framed in for the purpose of supporting the works above; in the centre of the said two pieces of timber is another piece of timber framed in, and connecting the two principal pieces, in the form of the letter H. In the centre of the last named connecting piece of timber is a follower bush, through which the spindle extends. The bush is of two half circular pieces, which embrace the spindle and keep it steady. The bush is tightened to the spindle, at pleasure, by means of two wedges. This connecting piece, in the form of the letter H, referred to, should be about 8 inches square; in this connecting timber is a mortice about 16 inches in length, 4 in width, and 4 in depth. The spindle enters the centre of this mortice; at each extreme end is a notch across the timber, or connecting piece, the exact depth of the mortice, say on one side 6, the other 4 inches wide; the above named bush is placed in this mortice, the circular ends pointing to the centre, to hug the collar of the spindle; the wedges, above alluded to, are to be placed in the cross notches, and are intended to loosen or tighten the bush at pleasure; the face view of the mortice and notches, above alluded to, will appear as in the margin. The next part of the work, which occurs in ascending, is the platform made on the top of the husk and on the connecting timbers above named. Through



the centre of this platform is a circular hole, cut about, or near, one-third less in diameter than the stones to be used. Above the circular hole, and around, the stones should be surrounded with a hoop, in two pieces, of sufficient size to admit the running of the stone inside, and high enough to shut up the opening between the two platforms. The meal spout comes out from the inside of the hoop, after the usual manner. The lower stone is the running stone, and is called the runner; it has an even horizontal face, except the furrowing, such as is in other mills, and is secured to the top of the spindle in the following manner, to wit; by a driver with four wings, made of cast or wrought iron, having in its centre a square hole, larger at bottom than at the top; the top of the spindle is made to fit the hole, extending through; on the top of this spindle a screw is to be cut, the driver being placed in its situation, is screwed there, by a nut, fixed on this screw. Through the end of each wing of the driver is an iron screw, to work in its place in the driver; this is put in from the under side, and by the use of a wrench is to be turned to regulate the stone by raising or lowering either side, with the view to place and keep it on a perfect level on the driver. The bottom stone is fitted to receive the driver, by letting in. Two holes are in the driver, in the wings, at opposite sides; the indentations or cuts of the driver are large enough to admit the heads of screws of sizes suited to the size of the stones. The screws being inserted head-foremost in the stone, are secured there by pouring in melted lead or pewter, thus leaving the points outwards. The stone is placed on the driver; the points of said screws, through the said wings, in opposite situations, are secured by nuts, which effectually fasten the stone to the driver, which remains firm, and free from wabbling. The second platform is raised by a strong frame on the two pieces of timber before mentioned, the height of which must be regulated according to the thickness of the stones. This platform should be composed of one solid and thick piece of timber, fastened to said frame-work below, and extending up through said platform, with nuts at each end of said platform; at each end also is a screw through the said top, and their points rest on the frame, or block, of the upright of the platform. This gives the means of raising or lowering the platform with the upper, and stationary stone. This stationary stone should be let three inches into the piece of timber that forms the upper platform, and be wedged fast and further secured by means of screws fastened into the stones as described above, extending upwards through the platform, and then secured by nuts. The frame to support the hopper, together with the hopper, shoe, damsel, or feeder, are formed and situated as in other mills in common and long use, and at the pleasure of the constructor. The damsel or feeding rod, extends through the centre of the said second platform, and stationary stone, and through a hole about one and three-quarters of an inch in diameter, and is fastened at the foot in the centre of the runner, by making a small hole, say one inch in diameter, and three inches deep, filled with firm and strong wood: a piece of hardened steel, square, but small at each end, and

much larger in the middle, is to be entered about one-half, in the last named wood, the other end to enter the foot of the damsel, or driver, which must exactly fit. Immediately below the shoe, and in the upper part of the hole through the platform, through which the damsel or feeder rod extends, is placed a tin or other funnel for receiving the grain from the shoe, and guiding it to the aperture through the platform, and upper stone.

The feeding is regulated as in other mills. This plan is intended to include all sizes of stones; but a size not less than 16 inches, nor to exceed two feet three inches diameter, is recommended; and a motion ought to be given of four hundred revolutions per minute. This mill is designed and suited to any kind of power, the same as any other mill in common use. The belt and elevators are to be put in operation in the same manner as in other mills.

What we claim as new and not in common use, and as our own discovery, in the above improvement and manufactory for grinding, and for the use of which we ask an exclusive privilege, is, that part of this mill which secures the following bush, and tightens or loosens it at pleasure; the manner of surrounding the stone by the hoop; the driver and its fixtures to carry and give steadiness to, and to level the runner; the securing and confining the runner and driver together; the manner of fixing the upper platform which receives and holds the stationary stone; the screws to raise or let down the said upper platform, and with it the stationary stone, and confine it to its proper and exact position; the fixtures of the damsel in the runner; and the use of the funnel for the purpose above specified. All of which last named specifications we claim to be new, useful, and our own invention: all other parts mentioned in the foregoing specifications have long been in common use.

JAMES SMITH.
WILLIAM SAPP.

Specification of a patent for a machine for planting of different seeds. Granted to AUSTIN H. ROBBINS, *and* LEVI ROBBINS, *Junr. of Denmark, Lewis county, New-York, August* 13*th*, 1828.

THIS machine, for which we claim a patent, and which performs the operation of planting, is placed upon a frame and wheel, similar in construction to that of a wheel-barrow. The length of the barrow frame is five feet, including the handles, and sixteen inches in width; and the wheel twenty-one inches in diameter. The axle of the wheel is like that of a common wheel-barrow, save near the wheel, there is a whirl turned on the axle, of different diameters, for the purpose of regulating the movements of the machine; and around which, a cord or a strap passes. There are two cross pieces, connecting the handles or arms; the first is thirteen inches, the second twenty-nine, from the centre of the axletree. From the centre of the second

cross piece, to the centre of the under side of the first, a piece, or perch, of wood, in a square form, passes, giving an inclined pitch of about five inches forward, to the same. This perch is secured to the cross pieces, at each end, by a bolt, screw, and nut; from this perch, two standards or posts arise, seven inches in height; on the first, immediately under a cross piece, hereafter described, is placed a shieve or pulley block, of different diameters, against which the cord or strap passes, in order that it should not chafe against the wheel, and to give ease to the motions of the other parts of the machine; the standards are united at the top by a cross piece, under which cross piece are two short knobs pressing upon the parts or boxes underneath; under this cross piece, and resting upon a short post or standard, which beneath rests on the perch, and also on the perch itself, is placed the improvement or invention claimed. The first thing to be noticed is, a circular box of the capacity of a half-gallon, more or less, resting in part upon the short post or standard, on the perch before described, and on another circular box placed directly on the perch below. The first box is perforated at top for the admission of a funnel, through which the seed is deposited in this box; and there is a circular plate of tin near it, capable of being turned, to close the aperture, when the funnel is removed. This box can be made of wood, tin, or sheet iron, or parts of either. There is a communication between, this box, and the one directly beneath, by means of a square orifice, at the inclined end of the box, guarded by a lip made of tin, to prevent the too free admission of seed, from the upper to the lower box. The lower box is five or six inches in diameter, and two and three-quarters deep. In this box is a circular plate, of wood or iron, to fit exactly in the box. The thickness of the plate, together with the diameter of the holes, regulates the quantity or number of seeds to be planted at one time. This circular plate is perforated with holes equi-distant from each other, and equi-distant from the circumference. This circular plate revolves round a spindle of sufficient length, to reach through the perch, the two boxes above, and the shieve, and about a quarter of an inch above the shieve, where it enters the cross piece, leading from the two upright posts, before described. On this spindle, immediately above the upper surface of the bottom of the lower box, is a shoulder, whereon the circular plate before described rests, and performs its revolutions. This spindle can be made either of wood or iron, the diameter about a quarter of an inch, and to correspond with the hollow of the cylinder, through which it passes. The passage of this cylinder through the upper box, or the orifice, through which it passes, is sheathed with tin. There is in the bottom of the lower box, an orifice directly over a hollow shaft, attached to the perch; the shaft is twenty inches in length. This shaft, at the bottom, penetrates the earth, and is sheathed with iron or steel in an angular form, the apex of the angle being towards the wheel; it may penetrate the earth to any required depth, and is open at the back and bottom, about three-quarters of an inch wide, through this the seed passes, and is deposited in the earth. This shaft is sup-

ported below by a brace, secured to the second cross piece by a bolt, screw, and nut, passing through the perch, cross piece, and brace. A cord or strap being placed on a whirl of different diameters, on the axletree, and passing from thence round the shieve or pulley block, laying flat upon the outer surface of the upper box, by pushing and moving the barrow forward, the revolution of the wheel and axle gives motion to the shieve or pulley block; and that, by being connected by means of a hollow perpendicular cylinder to the plate in the lower box, causes a circular horizontal motion to be given to the said plate, perforated as before described. These holes of consequence pass over the aperture of the lower box. The seed passes from the upper box, through the aperture, guided by the tin lip, before described, falls into the lower box upon the inclined side, and upon the circular revolving plate; and as often as the holes of the circular plate pass over the aperture of the lower box, the seed goes from thence into the hollow shaft, and is operated upon by a spring attached to the lower surface of the upper box, in order that no interruption may occur in the passage of the seed from the box, to the depository in the earth.

What we claim as new, and as our own invention or discovery in the above described machine, and for the use of which we ask an exclusive privilege, is, the whole machine above described, excepting the invention of the wheel-barrow. But we also claim the application of the wheel-barrow as our invention, to the use of the said machine. In witness whereof, we have hereunto subscribed our names the 1st day of August, in the year 1828.

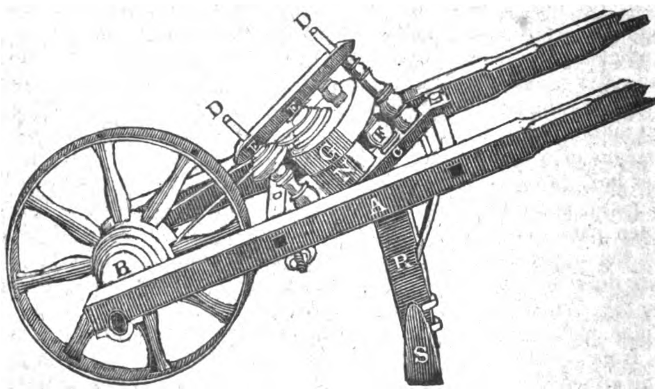
AUSTIN H. ROBBINS.
LEVI ROBBINS, Jr.

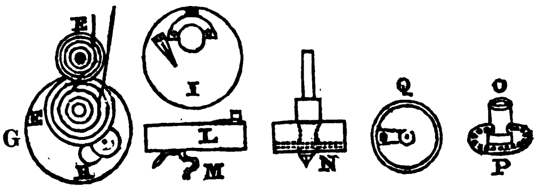
Remarks by the Editor.—The foregoing machine has been for some time in operation, and has been found to answer the intended purpose in the most perfect manner. An intelligent gentleman who resides in the neighbourhood of the patentees, writes thus; "there can be no difficulty in the application of this machine to the planting any kind of seeds, and any number of them at a time, and at any required distance, as fast as a man can walk. When the rows are set four feet apart one way, and eighteen inches the other, there is no difficulty, nor is it a very hard day's work for a man to plant ten acres, after the ground is properly prepared to receive the seeds."

To the cotton planter, this machine will, we are persuaded, be particularly beneficial, not only as regards the saving of time, but also in the perfect regularity with which the rows may be planted. In applying it to this use, it will, probably, require some modification of the spring, on account of the fibres which remain upon the seeds; this, we are convinced, can be made without any difficulty.

On the next page are the drawings and references, attached to the specification.

A. H. AND L. ROBBINS' PLANTING MACHINE.





A, the frame.	B, the whirl on the wheel.
C, the inclined perch.	D D, standards or posts.
E E, shieves or pullies.	F, short post or support.

G, the upper box, into which the seed is put.
H, opening in the top of the upper box.
I, lower side of box G.
K, square orifice with its guard of tin.
L, side view of the upper box.
M, a spring, which forces out the seed to be sown.
N, lower box.
O, hollow cylinder attached to P, the lower plate.
Q, lower side of lower box.
R, hollow shaft through which the seed passes into the ground.
S, sheathing of iron, or steel.

Specification of a patent for a Machine for Planting Grain and other Seeds. Granted to ORSON STARR, *of Richmond, Ontario county, New York, August* 22, 1828.

A BOX, or hopper, of a suitable size, is provided for holding the seed to be planted. This is to be firmly fixed upon a carriage, or bench, framed together for that purpose. This carriage has handles like the common plough, and is furnished, on the fore part, with an

iron, which is formed like the shovel of the common shovel-plough, for the purpose of forming the furrow or drill, into which the seed is to be dropped. The carriage runs upon two wheels, which are firmly fixed upon an axle which turns with the wheels, being furnished for that purpose with collars, or boxes on each side of the carriage; this axle crosses the carriage immediately under the box, or hopper. Upon the middle of the axis, a third wheel is fixed, but of less diameter than those upon which the carriage runs. The bottom of the box, or hopper, has a slot, or opening, through it, to admit the middle wheel to pass through, so that in revolving, the upper part of the rim will be within the box containing the seed to be sown. This wheel is usually made of sheet iron, and is in the form a cylindrical drum; the edge of it is perforated at suitable distances, to receive pieces of metal, which act as valves, working upon a pin, and forced out by springs contained within the wheel, so as to project beyond its periphery, but capable of being forced in, and to be flush with the rim, when passing the ends of the slot, in the bottom of the box. These valves are excavated so as to contain the quantity of seed required, and may be more or less numerous, according to the distance at which they are to be dropped in the furrow.

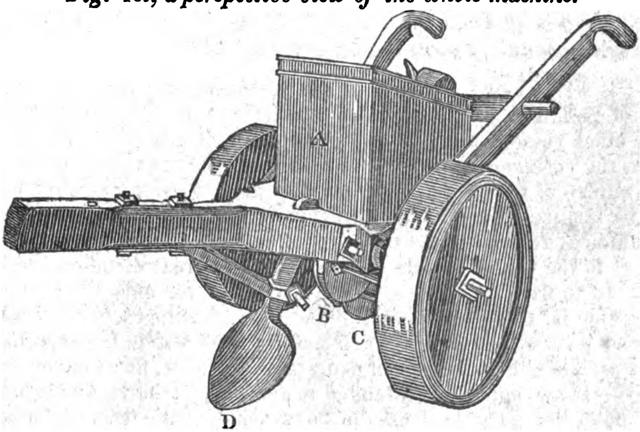
Behind the seed wheel there is an iron scraper, fixed to the frame of the carriage, of a proper form for closing the earth over the furrow in which the seed has been planted.

The whole machine may be varied in its form and dimensions, as well as in the materials of which it is composed; but what I particularly claim as my invention, or improvement, is the centre wheel, with its valves working in the manner above described and specified.

ORSON STARR.

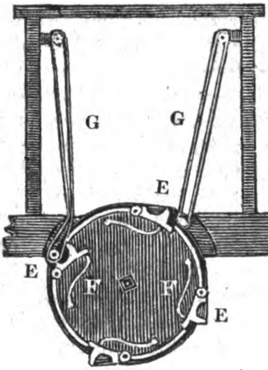
ORSON STARR'S MACHINE FOR PLANTING GRAIN, &C.

Fig. 1st, a perspective view of the whole machine.



A, the box, or hopper, for holding the seed.
B, the centre, or planting wheel.
C, the scraper to close the earth upon the seed.
D, the shovel.

Fig. 2 *a section of the box and planting wheel.*



E, E, E, E, the valves hollowed to receive and drop the seeds.
F, F, springs to force the valves out.
G, G, leather straps passing round slots or cleets, and against which the valves work.

Specification of a patent for an improvement in the mode of propelling Vessels upon the water, and carriages upon the land, by the combined action of Steam and the pressure of the Atmosphere, without the use of Paddle Wheels. Granted, in pursuance of a special act of congress, passed May 24, 1828, *to* EDWARD ALLEN TALBOT, *of Dublin, in the kingdom of Ireland, but now residing in the United States. Patent issued, June* 21, 1828.

IT is well known, at least to the scientific engineer, that by the use of paddle wheels, ordinarily applied to the propelling of boats and other vessels, there is very great waste of power, arising in part from the construction of the wheels themselves, but principally from the nature of the fluid upon which they have to operate, which, owing to the facility of displacing it, renders it necessary, in order to attain a sufficient resistance for the purpose of propelling large vessels, to resort to the use of paddle wheels of a very great diameter, varying from 16 to 24 feet. The great, although not the only object, of my invention is, therefore, to obviate these disadvantages, by the application of a resisting power, which shall operate within the vessel, and thus preclude the necessity of using paddle wheels, floats, or any other instrument or apparatus intended to act upon the surrounding water. To effect this purpose, I use (in the absence of any cheaper or more efficient power) a steam engine of any description, giving, however, a preference to the Boulton and Watt's low pressure engine. I shall, therefore, confine myself, in this specification, to the action of

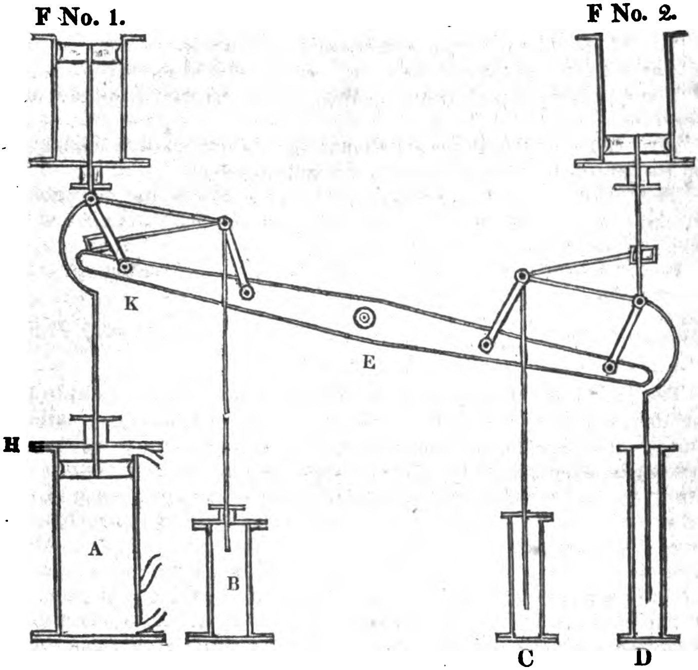
this engine. In the annexed drawing, A is the steam cylinder, B the air pump, C the hot water pump, D the cold water pump, E the beam and parallel motions, F, F the atmospheric cylinders. The whole of this machinery is placed horizontally, the atmospheric cylinders having their open ends towards the stern of the vessel intended to be propelled. The working beam is attached to the piston rods by segments or parallel motions. The piston rods of the atmospheric cylinder, F No. 1, and the steam cylinder A, are connected together, and the axes of the cylinders being in the same horizontal line, their pistons move simultaneously;—I have not been particular in representing the valves, steam boxes, steam pipes, and other appendages for the induction and eduction of steam and other purposes, as they may be constructed and placed in various ways, according to the fancy or the judgment of the engineer. I have merely drawn the pumps, to show how they and the valves may be worked by the beam E. I do not assign any particular dimensions to my cylinders, or to the other parts of the engine, as these must vary according to the power required; nor do I give the relative proportions of the steam and atmospheric cylinders, as those also will depend upon the velocity with which it may be deemed adviseable to work the steam piston. But for the purpose of explaining the action of this invention, I will assume certain arbitrary dimensions, and exhibit in numbers, what I conceive will approximate sufficiently near to the truth, to render manifest the great superiority of this mode of propelling vessels, to all other methods heretofore practised. Suppose a vacuum to be effected behind the pistons of the atmospheric cylinders, the whole weight of the atmosphere will press upon their faces, and allowing the pistons to be 40 inches in diameter, this pressure will amount to about 17,600 pounds upon each piston; hence the fulcrum of the beam, E, will be pressed in the direction of the bow of the boat, with a power of 35,000 pounds, whilst the cylinders will be pressed in the opposite direction by the same power. Thus far the boat will be no more affected by the creation of the vacuum, than if it did not at all exist. Taking it then for granted, that it will require, in addition to the pressure of the atmosphere upon F No. 1, an application of steam in the cylinder A, capable of exerting a force of 1000 pounds (above what is necessary to overcome the friction) to force out the atmospheric piston F No. 2, with a velocity of 80 feet per minute, it will obviously require a steam power of 19,600 pressing upon the same side of the steam piston, to force out the same atmospheric piston with a velocity of 160 feet per minute. Then, if the steam cylinder be 48 inches in diameter, the area of whose piston would be 1810 2-7 inches, and supposing the vacuum perfect, and the pressure of the atmosphere to be equal to 14 pounds upon every square inch, and the steam gauge to stand at 6 inches, there would then be a pressure of 17 pounds per square inch upon the piston and 17 × 1810 2-7 = 30.774 6-7. Now if we deduct one-third of this as an allowance for friction and working the pumps, a disposable force of considerably more than 19,600 pounds will remain; and this, divided into horse power according to the estimate of Boulton and

Watt, will be found equivalent to the work of 142 horses; or, in other words, the boat will be propelled by a constant force of 19,600 pounds, as may be proved by the following calculation. The pressure of the atmosphere upon the close ends of the atmospheric cylinders, the diameter of whose pistons is assumed to be 40 inches, amounts to 17,600 pounds upon each; consequently, the boat is pressed in the direction of the stern, by a power of 35,200 pounds. As the steam cylinder is close at both ends, it is not affected by the pressure of the atmosphere, or rather it is kept in equilibrio by its equal action on both ends. Now, when the steam enters into that end of the steam cylinder marked H, it will press the cylinder towards the stern with a power of 30,774 6-7 pounds, making in the whole, a pressure of steam and atmospheric air equal to 65,974 6-7 pounds, the tendency of which would be, were there no reacting power, to drive the boat stern-ways. But as the end of the beam marked K, is pressed towards the bow by the united influence of the weight of the atmosphere upon the piston F No. 1, and the force of the steam upon the steam piston, making together a power of 48,374 6-7 pounds, the entire of which is required to overcome the friction, and force out the atmospheric piston F No. 2, with a velocity of 160 feet per minute, the fulcrum of the beam will be pressed in the direction of the bow, with a power of 96,749 5-7 pounds, from which deduct 65,974 6-7 pounds, and there will remain, forcing the boat ahead during the first stroke of the piston, 30,774 6-7 pounds, minus the friction. Now, during the completion of the second stroke, the atmospheric cylinders will, as before, be pressed towards the stern by a power of 35,200 pounds, whilst the steam cylinder will now be pressed in the direction of the bow, with a power of 30,774 6-7 pounds, and the fulcrum of the beam, with the full pressure of both the atmospheric pistons; leaving, as before, a balance of power to propel the boat ahead, amounting to 30,774 6-7 pounds, minus the friction. Now, deducting one-third of this for friction, the boat will be continually under the influence of a propelling power, exerted to drive her ahead, of upwards of 20,000 pounds, a force equal to that which would be exerted by a 1400 horse power engine, driving paddle wheels 24 feet in diameter, and whose piston should travel at the same velocity that I assign to mine, namely 160 feet per minute, and whose consumption of fuel and steam would, consequently, be nearly, if not entirely, in the proportion of ten to one of mine. It will be evident, to every practical engineer, that power of any kind may be applied to this invention, and that it will be found equally adapted to the propelling of carriages upon land, as to vessels in the water. It is not, therefore, any monopoly in the use of the steam engine separate from this invention, that I seek. *It is the application of the pressure of the atmosphere as a resisting medium*, through the instrumentality of which I can, by the aid of a steam engine connected with my atmospheric cylinders in the manner here described, propel vessels or carriages of any description, without, as it regards the former, allowing any part of the machinery to act upon the water as a resisting medium, or as it respects the latter, being obliged to re-

sort to the use of wheels, cranks, or other contrivances intended to operate upon their wheels or axles.

EDWARD ALLEN TALBOT.

E. A. Talbot's Propelling Engine.



Remarks by the Editor.—Agreeably to the promise made in the August number of this Journal, we have given the specification of Mr. Talbot's engine, with the requisite drawing. The patentee is evidently a gentleman of much intelligence and science, and, of course, has the fullest confidence in the correctness of the principles upon which his machine is intended to act. Several gentlemen in Washington, who, deservedly, rank high in the scientific world, have entertained opinions respecting it, sufficiently favourable, to cause an experiment to be made; we were not present, and of the result we are not particularly informed; we understand, however, that the patentee is about to try the thing on a large scale.

We have endeavoured to discover in the arrangement proposed, some efficient power to propel a boat or carriage, but, although the inquiry has been instituted, with an unfeigned deference to the opinions of some of the gentlemen above referred to, it has been in vain. We are still entirely in the dark, and ready to submit, patiently, to the imputation of stupidity, whenever, by means of this apparatus, a boat shall have been made to travel a mile, in still water.

Franklin Institute.

The nineteenth quarterly meeting of the Franklin Institute, was held at their Hall, on the 16*th Oct.* 1828.

Mr. Isaiah Lukins, was called to the the chair, and

Mr. M. D. Lewis, appointed Secretary, *Pro tem.*

The minutes, of the last meeting were read and approved.

The quarterly report from the Board of managers, was read and accepted.

The report of the Premium Committee, to the board of managers, on the late exhibition, was also read and approved.

The meeting then proceeded to elect a Recording Secretary, in the place of Dr. T. P. Jones, resigned, when Mr. Algernon S. Roberts was unanimously elected.

Isaiah Lukens, *Chairman.* M. D. Lewis, *Secretary, P. T.*

Nineteenth quarterly report of the Board of Managers of the Franklin Institute.

The Board of Managers of the Franklin Institute, present to the members the nineteenth quarterly report, containing their transactions during the term which has elapsed, since the last general meeting. In this period events have transpired interesting in a high degree to the Institute, and which seem calculated to diffuse a proper idea of the value and importance of the institution, not only in our own community, but among the mechanics of the country generally. Among these the Board mention with peculiar pleasure the fifth annual exhibition, which was opened on the eighth day of the present month, at the Masonic Hall, and closed on the eleventh. The committee of premiums, have obtained the reports from the respective committees appointed as judges of the particular articles exhibited, an abstract of which is presented in their general report, which also contains the award of the premiums, in conformity with the conditions published.

There appears to exist now but one opinion of the value and utility of these exhibitions, not only as a means of exciting the emulation of Artisans and Mechanics, and consequently of producing a superiority in the workmanship and quality of the articles exhibited, but as serving also to diffuse a correct knowledge of the present state of American manufactures. Although in the late exhibition, manufacturers of goods of several kinds, neglected or failed to supply specimens of the productions of their establishments, there were many articles which were new, and a striking evidence was afforded of considerable improvement in quality and finish, in the kinds heretofore furnished. The regulations of last year were adopted, and it was universally acknowledged, that the small charge for admission, contributed to promote the comfort and convenience of the visiters. Although members were admitted with two ladies gratis, there was received for tickets, at the rate of twelve and a half cents each, the sum of seven hundred and fifteen dollars.

The board have witnessed with great satisfaction, the attention of those gentlemen who were appointed as managers of the exhibition. In the execution of their duty, a very considerable portion of their time was consumed both before and during the exhibition; the neatness and order of the arrangement of the different articles exhibited, fully proved how faithfully they executed the trust committed to them.

The necessary arrangements have been made for the opening of the drawing school, and for the delivery of some of the lectures for the ensuing season. Mr. Hugh Bridport, will continue his superintendence of the former department, assisted by Mr. George Strickland, who is advantageously known to the public, for his skill in architectural drawing. The board regret that the drawing school has not been patronized, in a manner, such as its manifest utility and the talents of its instructers would seem to demand.

In consequence of the vacancy in the professorship of mechanics and natural philosophy, not being yet supplied, the requisite arrangements for the delivery of that course, have not been made. A special committee has been appointed on this subject, and the board have no doubt of obtaining the services of a person qualified to deliver lectures on these subjects.

Dr. Bache will deliver a course of chemistry, as applied to the arts, to commence early in November.

The board is desirous that a course of lectures on mineralogy, and geology, should also be delivered, and are endeavouring to procure the services of some competent person.

Saturday evenings will be reserved for volunteer lectures.

The board have referred the subject of a system of text books for the younger part of the audience in attendance upon the lectures, to the committee of instruction and the professors, and hope the most beneficial results from their introduction. All which is respectfully submitted, on behalf of the board of managers, by

Samuel W. Robbins, *Chairman.*

On the Combination of a Practical with a Liberal course of Education. By W. R. Johnson, *Principal of the High School of the Franklin Institute.*

No. V.

The duties of the several classes of persons employed to give instruction, or to maintain discipline, under the High School system, next require attention. It may not be improper to observe in passing, that the term *system*, as here used, is applied to the whole combination of means by which the intellectual, moral, and physical improvement of youth in schools, is to be effected. This remark is the more necessary, on account of the confusion which an erroneous application of the term has often produced in the conversations and writings

of those who have undertaken to discuss the subject of education. They sometimes call that a *system*, which is, in fact, only a *method*, and approve or condemn the former on account of some real or imaginary defects in the latter. A system necessarily embraces several methods, and requires several persons to execute it. The methods of teaching may, therefore, sometimes be good, while the system into which they are incorporated, is in other respects essentially defective; or the general system may be good, and yet contain some methods at variance with its spirit and character. A method may often be executed by one who possesses little power of combination, and who would be wholly unfit to direct a system. As a method bears to a system the relation of a part to a whole, so it is in turn divisible into parts or *sub-methods*, some more, and some less difficult of execution, some demanding little maturity of judgment, and others requiring the utmost skill, discernment, and strength of character to ensure their success.

This difference in the degrees of difficulty in the several duties of instruction, is the foundation of the peculiar arrangement and distribution which, under the High School system, is made of the offices of *teachers*, *tutors*, *and monitors*. By that distribution, all the more easy and mechanical parts of teaching, all those parts which, from their very facility, and from their "constant, stale, and tasteless repetition," become burthensome to the adult teacher, are performed with alacrity by tutors or monitors, for whom they still wear the charm of novelty, and to whom they afford excellent opportunities for increasing their expertness, or evincing their previous attainments. At the same time the powers and energies of the master, are brought to act wherever the nature of the subject requires much elucidation, and wherever taste and judgment are more concerned than memory, alertness, and dexterity. The irksomeness of teaching, is thus greatly diminished, and still, by means of frequent examinations, and daily reports respecting the state of preparation, the responsibility of the pupil is fully sustained. The number of teachers employed in the institution, is seven, of whom one instructs in the ancient languages and the English branches; one in each of the modern languages, French, Spanish, and German, and one in drawing; one has the charge of the preparatory school, and another teaches penmanship, in the same department. Additional teachers are employed, when the number of scholars, or of branches to be taught, demands increased assistance.

The duties of teachers consist in instructing the tutors and monitors in their respective branches, and all the other members of their classes in those parts of the subject which require a master's talents; in superintending classes while reciting to monitors; preserving order; prescribing the methods to be pursued; minutely inspecting the operations of the several divisions to which they pass in succession; and in hearing appeals from the decisions of monitors, when made in conformity to the rules of the class. They also examine scholars in those parts of their studies which have been pursued under monitors, and give credit to the latter, according to the manner in which they

have executed their trust. Each master keeps a journal, in which he enters all credits and discredits of the monitors and pupils under his direction, specifying what number of exercises has been well performed, how many have been neglected, and how many imperfectly prepared. Many of these notes are taken from lists kept by the monitors, while others are the result of the teacher's own personal observation. The whole are, at the end of each half quarter, transferred to the register, to become the basis of a new classification, and to remain as permanent memorials of the scholar's character, at all times subject to the inspection of parents and others, who are interested in its contents.

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*Offer of a new and improved Plan of constructing Iron Rail-ways and carriages, by which all sorts of goods, merchandise and other articles whatever, as likewise Passengers, will be conveyed with much greater ease, convenience, and speed, and with less expense than could till now be effected, by employing either the power of Steam or that of Horses.**

It is generally acknowledged by the most eminent engineers and by the most impartial writers on mechanical subjects, that the present construction of rail-ways, and of the carriages or wagons conveyed upon them, is still very far from being arrived at that degree of perfection of which, by their principle, they appear to be susceptible, and it cannot be denied that, upon the whole, this most valuable invention is yet in a state of infancy.

To this imperfect state it is undoubtedly owing that those artificial roads, though known, and partially used, for a century past, have, till now, not been extended to a more general application over whole countries, and for all sorts of conveyance; that the greatest part of those companies which a few years ago had associated themselves for the establishment of rail-ways in different directions all over England, have been dissolved, and that almost none of those numerous and magnificent projects which were announced in the English papers, has been carried into execution.

It is, therefore, my opinion, that, before any important and extensive plan of that kind can be adopted with a certain prospect of suc-

* A printed copy of this interesting article has been communicated to us by a very distinguished individual, who received it from the Chevalier De Baader. The details of the plan have not been made known, nor will they be, until measures have been adopted to secure to the inventor a fair compensation for his improvements. As but a single copy of the printed "offer" has been received, we have thought that its insertion in the Journal, would be likely to call public attention to the subject, and, probably, promote the views of M. De Baader. The paper was printed at Munich, in the English language, and, as the intentions of the writer are sufficiently clear, it has been thought best to copy it verbatim. EDITOR.

cess, it will be necessary to bring those roads, with their vehicles, and all their other mechanical contrivances, to a higher degree of perfection, by removing all the difficulties and inconveniences to which, in their present state, they are subject.

In the first place, on the flat rails, or tram-ways, as well as on the edge-rails, the continual rubbing of the wheels against the upstanding rims of the plates, or of the projecting flanches of the wheels against the sides of the rails, causes a considerable resistance, by which not only a great part of the moving power is wasted in a useless manner, but which also tends to loosen the rails, and disturb their foundation. This is particularly visible on all sorts of rail-ways where the carriages are drawn by horses, who, by their trampling, shake the sleepers, and the whole foundation, in such a manner, that the rails become in a short time loose, with their joints displaced, their ends standing up, and their parallelism destroyed; the immediate consequences of which, are, an increased resistance, violent jolts, frequent breakings of wheels and rails, continual repairs and delays, and the speedy destruction of the whole work.

2ndly. Where horses are employed, the flat as well as the edge-rails, but particularly the first, are continually filled, and covered, with sand, gravel, or mud, thrown up by the feet of those animals, so that the rails often become so obstructed as to occasion a considerable resistance to the carriages passing on them.

3dly. With regard to the wagons, or carriages, used upon either of these rail-ways, their present construction is so clumsy and defective in every respect, that they hardly deserve the name of *Machines*. As both axle-trees are immoveably fixed on the body of the wagon, or tram, these vehicles can only go forward and backward in a straight line, and the least deviation from that line occasions a very considerable rubbing and fretting of the wheels on the bottom, and against the sides, or rims, of the rails, and, of course, a great additional resistance, with a most destructive wear and tear of the rails and wheels.

4th. On such places where a rail-way ceases, or, where it must be interrupted, which is unavoidable upon long lines passing through towns, over long and narrow bridges, etc., these wagons are incapable to leave the rails, and to be brought over any common road, paved street, or other ground. They must, therefore, be unloaded, and their contents carried on, upon common carriages—a very troublesome operation, which is always attended with expense and great loss of time.

5th. One of the greatest objections to the present system of rail-ways, is, that the carriages are so confined to the track of the rails that they cannot, like common carriages upon a turnpike-road, turn out to pass each other when meeting upon the same line, or where a slower moving train is overtaken by a quicker one. The siding places, or turn-outs, employed for that purpose in England, are but a very imperfect and bungling contrivance. They can only be placed at certain distances, and are of no use to the carriages meeting between those places. Their management is extremely tedious and

troublesome, and though, for want of a better and more convenient method, they may answer in some degree for the slowest transports, they will be of no service at all for quick conveyances, on account of the great loss of time attending every such operation, and of the danger of the carriages running foul of each other, because the *momentum inertiae* of such masses cannot be stopped so quickly and easily upon a rail-way, as upon a common turnpike-road.

6th. As the principal advantage of rail-ways, and their great superiority over canals, consists in the quickness of conveyance, and in the possibility of employing mechanical power instead of horses, the application of locomotive and stationary steam-engines, has been proposed, and partly introduced in England, for the propelling of all sorts of vehicles upon iron rail-ways. But of all the trials which till now have been made, not one has yet succeeded to such a degree as to answer fully the sanguine expectations of their projectors. The greatest speed which, with either of these engines, can be given to a train of heavy loaded carriages, without the most imminent danger of dashing both rails and wagons to pieces, does hardly exceed six miles an hour; and as the greatest part of the power of the locomotive engines is absorbed by their own weight, and of the stationary engines by the weight and friction of the long ropes or chains, the expense of fuel is very considerable, and surpasses the expense of horses wherever a ton of coals costs more than 8 shillings.

Being perfectly acquainted with all the newest mechanical inventions, by a stay of nine years in England, and strongly impressed with the high importance of this particular subject, I have for these twenty years past applied myself with the greatest assiduity to the improvement of rail-ways, and by constant study, and after many expensive experiments, I have at last succeeded in hitting upon an entirely new plan, by which all the difficulties and inconveniences here enumerated are completely removed, and the conveyance upon rail-ways is brought to a degree of perfection which, till now, was scarcely thought possible.

The principal advantages of this new plan are as follows.

The rails are constructed in such a manner that the carriages move along them with the greatest facility, and without any sensible lateral friction, though the wheels are regularly kept upon their track. By this means, and by a more advantageous, yet simple, construction of the wagons, the resistance is so much reduced, that upon a dead level the power of one horse is sufficient to draw, with ease, and in a good pace, a load of 12 to 14 tons upon several carriages linked together.

The foundation of the rails is fixed in a much more solid manner; and, as the horses do not walk between the rails, but on the outside of them, and upon a separate path, which is somewhat lower, their trampling cannot injure the foundation, nor can they throw any sand or mire upon the rails, which, of course, will never be obstructed.

The peculiar construction of the carriages allows them not only to turn without the least difficulty in any deviating direction, and upon a curved rail-way of the shortest radius, (f. i. of 20 feet,) but also

to leave the rails, and to be conveyed over common roads like any ordinary wagon. These carriages, therefore, can go on without interruption, through towns and villages, and over bridges, where the rails cannot be continued, remaining loaded till they arrive at their final destination.

By a very simple and easy contrivance, my carriages can also be turned off the rails, at any point where it will be found necessary, either to avoid other wagons meeting on the same track, or to pass by those which they have overtaken, and return again into their first line; so that no siding-places, turning plates, nor any other apparatus of that kind are necessary for such an operation, which can be performed almost as quickly and easily as upon a common turnpike-road.

This very important improvement affords the advantage, that a double track of rails will be sufficient for the most frequented traffick, or intercourse, for which, in the common way, five or six parallel tracks would be required; and that any number of slow and heavy wagons can pass on the same line, and at the same time, with as many light and quick carriages, in the same, or in an opposite direction.

To employ the power of steam with the greatest advantage, and with the least possible expense, for the propelling of all sorts of carriages upon rail-ways, I have discovered a new principle, by which the power and motion of stationary engines, established at considerable distances, or intervals, and working without interruption, can be imparted to any number of loaded carriages passing upon a rail-way, from one engine to the other, *without ropes, or chains, or any other intermediate apparatus*, and with any (reasonable) velocity.

A rail-road constructed any where upon this new plan, and with all these improvements and new inventions, the reality of which is partly proved by experiments made upon a pretty large scale, partly founded upon the most infallible principles, (and for the success of which I will make myself responsible) cannot fail to have a decided superiority over canals, as well as over common rail-ways of the present construction used in Great Britain.

This superiority has already been acknowledged by a committee of the Royal Academy of Sciences, and by one of the Agricultural and Polytechnical Societies at Munich, who, after having examined my plan, and assisted at the experiments, have made and published very favourable reports. And though there is in this country a strong interested party for canals, yet all our proprietors and capitalists, and also the majority of both houses of our representative assembly, are so well instructed and disposed, that my plan for uniting the two greatest navigable rivers in Germany, the Danube and the Rhine, (through the Mayn) by means of an iron rail-way of my invention, is about to be adopted.

But I am convinced that no where in the world the introduction of this new plan of rail-ways could afford such immense advantages as in the United States, where the most rapid and prodigious progress in every branch of internal improvement, industry

and commerce, protected by the wisdom of an enlightened and liberal government, and supported by the public spirit of an enterprising nation, are already the admiration of all Europe; and where, to arrive at the highest degree of national wealth and prosperity, nothing more is wanting, and nothing can be more desirable, than the greatest possible multiplication, and facilitation, of internal communications.

By adopting this plan, instead of the ordinary English system, the iron rail-way between Baltimore and the Ohio, the construction of which is already decided upon, might be established with much greater advantage and with a saving of nearly two millions of dollars.

It has lately been proposed to unite the Chesapeake-bay with the Ohio, by a canal between Georgetown and Pittsburg, and the expense of this canal is previously estimated at 22,575,426 dollars, of which sum nearly one-half will be required for the middle section alone, on account of the great number of locks, and a most expensive tunnel, by which this part of the canal is to be conducted over the highest point, below the summit of the Backbone mountain. As far as I am able to judge, by the report transmitted by a message from the president of the United States, and published at Washington, last year, it appears to me that a double track of iron rail-ways, with a sufficient number of stationary engines, executed in the most complete and solid manner, would answer the purpose infinitely better, and save about two-thirds of that sum, and as much of the time required for the conveyance of all articles from one point to the other. Light vehicles with passengers, and mails, might be transported upon this rail-way with the greatest safety and convenience, in 36 hours, by day and night. Besides, there would be the very important advantage, that the rail-way could be used the whole year, with very few interruptions; whereas the navigation upon canals, in that climate, is generally confined to eight months. If, however, my plan would be adopted only for the middle section, upon the length of 72½ miles, a saving of 7 to 8 millions might easily be made, and the traffic carried on with much greater expedition. But, as, in this case, the loading and unloading from the canal to the rail-way, and from the railway to the canal, would be rather troublesome, and attended with extraordinary delays and expenses, I should recommend the construction of a rail-road for the whole line between Georgetown and Pittsburg, *by which about* 15 *millions of dollars would be saved, the whole work finished in a much shorter time, the expense of entertaining and repairs greatly diminished, the transports rendered more expeditious and convenient, and the annual income to the proprietors and share-holders might be doubled, even with lowering the tolls.*

The Chevalier Joseph de Baader,
Knight of the order of merit of the Bavarian crown, Counsellor of mines, and Professor of practical Mechanics at the University of Munich, member of the Royal Bavarian Academy of Sciences and of the several foreign learned Societies, One of the Directors of the Board of Agriculture and of the Polytechnical Society at Munich.

Munich, the 19th March, 1828.

NOTICES.

American Manufactures.—The recent exhibition at the Franklin Institute, together with similar displays in other parts of the union, have more than justified the anticipations of the most ardent friends of this species of national industry.

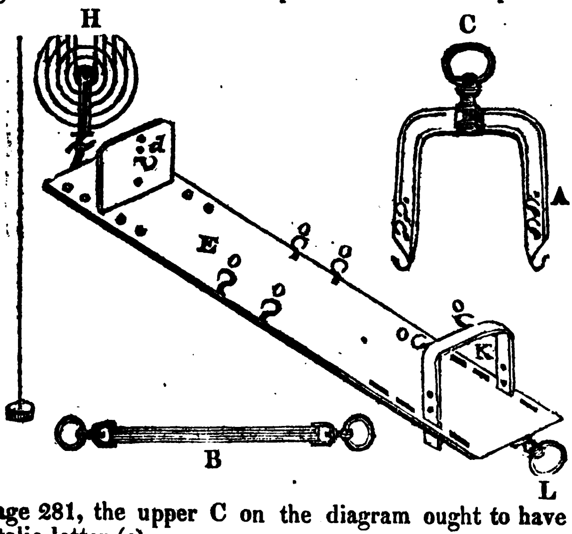
Nor has our progress been confined to manufactures of the first necessity; those which minister to our gratification as articles of luxury and of taste, have not lagged behind; the conjoined skill of the artist and of the artisan, decorates our persons and our dwellings, in a style which would be creditable to any country.

Whilst speaking on this subject, we acknowledge ourselves indebted to Messrs. C. Woodward & Co., whose card is inserted on the cover, for the gold tipped pen, with which we now write. The silver case, which contains the pen, and an ever-pointed pencil, is equally firm, neat, and elegant. There is an improvement in the socket, which is slit, this causes it to spring, and embrace the lead, and prevent its falling. We think it equal to the best imported.

ERRATA.

Owing to a mistake at the printing office, a part of the last number was put to press, without having been corrected by the Editor, and the errors are, in consequence, more numerous, than those of the whole preceding volumes, as special pains have been taken in this particular.

Nearly all the letters of reference on the cut of Casey's Dormant Balance, p. 269, were misplaced. We, therefore, insert it again, placing the letters so as to correspond with the description.



In page 281, the upper C on the diagram ought to have been a small italic letter (*c*).

Page 282, 18th line from top, for (E) *read* (D).

Page 283, in lines 11. 13. 15. for M, M, M, *read m, m, m.*

Page 284, 14th line from bottom, for Brighton, *read* Beighton.

THE

FRANKLIN JOURNAL,

AND

AMERICAN MECHANICS' MAGAZINE;

DEVOTED TO THE

USEFUL ARTS, INTERNAL IMPROVEMENTS, GENERAL SCIENCE,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

DECEMBER, 1828.

Directions for bending, blowing, and cutting of Glass, for chemical and other purposes. Extracted from Chemical Manipulation. By Michael Faraday, F. R. S.

(Concluded from p. 306.)

64. The *cutting of glass* in the laboratory, is an operation which is more frequently to be performed with tubes and rods, than any other form of glass. But, occasionally, oil flasks, retorts, jars, &c. are required to be cut into useful pieces, and several methods have been devised for the purpose. These, though not at all equal in accuracy and security, to the methods of the glass-worker, may be performed with such common tools as are to be found almost every where, require but little practice, are frequently efficient in facilitating experiments, and are highly useful to the student.

65. The method of cutting tubes or rods by a file, has been already described. (19) A cutting diamond will answer the purpose as well as a file, and even a sharp flint may be used, upon emergency. When a tube is very large, it is safer to go round the place, first with a diamond, and to perform the operation over a cloth, or some other soft substance, lest, as the pieces separate, they should fall and be broken.

66. In all cases in which a diamond is used, it must be remembered that a cut, not a scratch, is required. A scratch by a diamond, will rarely give direction to a crack, and is as likely to be crossed by one, as followed. A cut, on the contrary, is a division of the glass, independent of the abrasion, has actually penetrated some depth,* and is almost certain to be followed by any crack, or entire

* See Wollaston, Phil. Trans. 1816, p. 265.

division, that may come across, or even near to it. A cutting diamond operates well, only in one particular position, which should be formed by a trial upon a piece of crown glass, and, being ascertained, should be marked upon the handle, that in any future operation, it may always be in the same favourable position relative to the cut that is to be made. The scratching diamond is not fit for cutting, but is intended for distinct uses; nor should a cutting diamond be injured by employing it in writing and scratching upon glass.

67. Old retorts, flasks, globes, and other convex pieces of glass apparatus, are often cut by iron rings, into circular pieces, which then answer the purpose of dishes. The rings should be of different diameters, made of wrought iron, about the third of an inch in thickness, with a stem attached to them, by which they are fixed into a wooden handle. When made uniformly red hot, and brought into close contact with the convex surface of a glass retort or flask, a crack generally takes place, in a few moments, beneath the ring, which occasions the separation of the inner round piece. These pieces are sometimes used as evaporating basins; but, from their great tendency to crack, at the edges, and, gradually, to break to pieces, they are not safe in precise or important experiments. The rings are much more valuable for the facility with which they cut a flask in half, or, by similar operations, afford entrance into any other vessel, so as to allow of an examination of the interior, and the state of the substances it contains.

68. Thin fragments of retorts, flasks, and, especially, Florence flasks, are very useful for the evaporation of small quantities, but as these vessels are never required to be thus cut up, until they are broken, the cracks then existing, may by other means be led in advantageous directions, more conveniently, than by the iron rings.

69. Many pieces of glass apparatus, which have become useless, such as jars, bottles, globes, and, generally, those with convex surfaces, may be divided along a particular line, by means of a hot iron rod, and thus separated into useful pieces. The operation consists in leading a crack, either made for the purpose, or previously existing, according to the required direction. The iron rod may be nearly as thick as the little finger, and made tapering at the end, for an inch, or an inch and a half, to a blunt point. The line of division should be decided upon, and even be marked on the glass, with pen and ink; it may pass, without impropriety, over parts varying in thickness, but should not go suddenly from a thick to a thin part; thus it may be followed with ease, round the sides of a jar or bottle, but the crack could scarcely be led down one side of a jar, across the bottom, and up the other side.

70. It will rarely occur, that a vessel is to be divided, in which some previous crack, or broken edge, does not exist. The iron, being heated to redness, is to be brought with its point towards the crack, in an opposite direction to it, and the apex is to be laid upon the sound glass just before the crack, the iron rod being, at the same time, retained at an angle of about 20 or 30 degrees with the, as yet uncracked, glass beneath. The crack will immediately extend it-

self to the part of the glass with which the hot iron is in contact; and by gradually and slowly drawing the latter along the glass, before the crack, the division will follow it, and may thus be led in almost any direction. It may, when not carried too near to the edge of the glass, or to another crack, be made to turn off suddenly at right angles to its former course, or it may be led in gradually winding and curving lines. The crack should at first be led directly towards the line which marks the convenient division, and having reached it, that line is to be pursued until the separation is effected. When the rod has cooled considerably, or even when hot, if thin glass be experimented with, it is often difficult to carry the crack entirely round into the commencement, or into any other division; but in such cases, the small part which remains undivided, easily yields to the slightest mechanical force, the crack being then continued directly into the previously divided part.

71. The rapidity with which a division is effected, depends upon the temperature of the rod. It is not desirable to perform it very quickly, and, therefore, when very hot, the rod should be held at greater angles with the glass, than those mentioned, that the point only may touch it. As the heat diminishes, the rod should be more inclined, that the thicker part may be made to approach the glass, and by its heat and effect, compensate for the diminished temperature of the point. When still cooler, it may be desirable to use the thickest part of the rod instead of the point, laying it down in contact with the glass, before the crack, and drawing it along, but this can only be done on convex vessels.

72. If the direction to be followed, lies but a little distance from the line of an edge, or a previous division, the operation must be performed more slowly, and with the apex rather than the line of the rod; for the crack to be led has then a tendency to fly suddenly to the edge by its side. It is not easy, by this method, to cut nearer to an edge than the third or fourth of an inch.

73. If there be no crack to commence with, one must be produced in the following manner. If possible, an edge is to be selected, which, being an inch, or an inch and a half, from the line of division, may have a crack made in it without interfering with the part of the glass intended to be preserved; if it be a recent edge, viz. one that has been formed by fracture, rather than one which, existing at first on the piece of apparatus, has been fused, it is the more advantageous. The heated iron rod is to be applied to this edge, in a direction almost perpendicular to the glass, that the heat may extend to as little a distance from the place as possible, and when it has been in contact for a moment, if a division have not spontaneously occurred, the hot part is to be touched by a moistened finger: a crack will immediately be occasioned, and the smaller the distance to which it runs from the edge, the better; for once commenced, the smallest crack can be led as easily as the largest, and the opportunity of directing from the commencement, is secured. If the glass be thick, as that of a bottle or jar, it will usually fly by the heat alone; if it

be thin, as that of a Florence flask, it will, generally, require the application of moisture, after the heat.

74. If the crack is to be commenced in the middle of a plain, unbroken surface, great care is required, or the fracture will extend to a considerable distance, and, probably, in a wrong direction. The heated point should be applied to a single spot, and being soon removed, the place should be moistened. It is better to try two or three times unavailingly, than, by heating the glass too much at first, to incur the risk of an extensive fracture. The crack should always be commenced at some distance from the important line of division, that there may be less danger of the first and uncertain separation interfering with or crossing the latter.

75. In all divisions of this kind, the glass to be cut should be supported upon a cloth, that the parts on both sides of the crack may be sustained; or, when the division approaches its completion, the mere weight of one part may make the crack run in an inconvenient direction. The form of the piece of iron, is by no means essential, and a furnace poker, or a pair of tongs, in cases of emergency, may be used for these purposes. It may even be performed with a red-hot pointed piece of charcoal, the ignition being heightened by blowing upon it.

76. The edges which are exposed when glass is thus divided, are very liable to fracture by slight mechanical force, by heat, or by other causes, much more so, indeed, than glass of which the edges have been fused or ground. Hence, it is frequently advantageous, either to grind them, which may be done upon a flat stone with a little sharp sand, or emery, and water; or to soften and fuse them, which may be effected either by the table blow-pipe, bringing all parts of the edge in succession into the flame, or by a flat charcoal fire. When the edges are not thus finished, they should have a sand-stone, or a fine file passed over them, to remove the linear angles, which, being sharp, are dangerous to the fingers.

77. Jars which have been broken at the edges, may, by a process of this kind, be cut shorter, and then will long remain useful vessels. Bottles, of which the necks or upper parts have been broken, may be converted into small jars. Their stoppers should be added to those which already occupy a drawer in the laboratory, (84) and from which the place of an absent one may often be supplied. Broken test glasses may often be cut into useful forms; if but one-half or two-thirds of the cup be removed, the remaining part, with the foot, will serve for many voltaic decompositions; and, frequently, as a convenient insulating stand, in electrical experiments. If nothing but the foot can be preserved, still there are numerous occasions for its services in the laboratory; for the body being broken away, and the stem chipped off, which is done by striking it sideways with a file, or the edge of an iron spatula, a strong round glass disk remains. Such disks are very convenient as covers for the mouths of glasses containing precipitates, or other substances, to exclude dust during the time the experiments are in progress.

78. In cutting up large pieces of glass, by the method described,

especially if any importance be attached to the result, it is best to precede the application of the hot iron, by going round the part with a diamond. The iron then merely completes what the diamond had begun, and it is seldom that the separation departs from the track thus laid down for it. But the chemist should never undertake delicate or difficult divisions; the object of the preceding directions is, to enable the economical experimenter to cut up into useful forms, old glass which would, otherwise, be thrown away as waste. In more important cases, he will, of course, transfer it into the hands of an instrument maker.

79. Sometimes it is required that a piece of flat glass, as crown glass, should be broken into two or three smaller pieces. If this be attempted by means of a blow, the glass will, usually, shiver into many pieces, mostly long, with round edges, and of very inconvenient forms; a piece of the desired size or shape being rarely obtained. But, by contrivance, a piece of such glass may be divided into two parts only, with considerable certainty; the direction of the fracture also, being in some degree under government; and a long slip of glass may be divided into halves or quarters, or a piece of any form cut up into smaller parts, without difficulty. Suppose it were required to divide a piece of glass four inches long and two wide, into two nearly equal portions. An angular file (three-square or four-square) is to be placed with one end against an obstacle, as the edge of a table, and the other against the breast, so that by a little pressure, it may be supported with one of the edges upwards, and nearly in a horizontal line. The piece of glass is to be held with one end in each hand, and the middle of one of its long sides is to be applied to the edge of the file at that end nearest to the table or support, the glass being inclined a little upwards from the horizontal direction towards the operator. The operator is then to press with a moderate degree of force on the glass, drawing it along the file, from one end to the other, and, without taking it off, to turn it as it were over, so as to incline it in the opposite direction, and then carry the glass back again with about the same pressure, to its original place on the edge. In this way there is a tendency to notch the glass on the opposite sides of the same edge and place, which is sufficient to originate a fracture there, and as the glass is returned, it generally divides in the hands by a crack, commencing at the place where it was in contact with the edge of the file, and proceeding directly across between the hands.

The degree of pressure required, is quickly learnt, by a little practice on waste pieces of crown glass; it should be insufficient of itself, to break the glass, but sufficient when the small fracture is commenced by the file. It is better to make it rather stronger when the glass is returned, than when drawn towards the body; the former being the most convenient time and position for the fracture to take place in. The direction of the crack is regulated, chiefly, by the force applied by the hands, being usually across the line of resistance to that force; and hence, the opportunity afforded of giving it a direction by pressing with the hands equally on each side of the

line, along which it is desired the crack should pass, at the same time making it commence at the beginning of that line, by placing it on the edge of the file.

80. When all other means of directing a crack are absent, it may frequently be done with advantage, merely by the pressure of the nail. If a Florence flask be cracked, the division may be extended by putting the thumb over it, near the end of the crack, by pressing the nail when in contact with the glass, and carrying the thumb forward. The crack will fly before it, extending, on this side or on that, according to the direction in which the thumb advances, or according as the pressure is on one side or the other. The flask may thus be divided into pieces, much more useful than such as would result from crushing or breaking it entirely at random.

81. Pieces of glass are reduced at the edges in various ways. The corners may be removed from fragments of plate glass, by running a coarse file, with a light and rasping kind of motion, against the edges, in a position slightly inclined to the glass. The reduction takes place, not by mere attrition and wearing away, but by the removal of successive chips of glass, each tooth of the file carrying away a small fragment, perhaps the eighth or tenth of an inch across; in fact, of a diameter equal to the whole thickness of the plate. In this way, the large pieces are soon brought into a round form, and serve as valves. In the same manner, if, in cutting a thick tube, the aperture should not be level all round, the projecting parts may be removed piecemeal; but more care is required than with flat glass, from the tendency of cracks to form at the edge and fly up the tube.

82. The edges of plate glass may, also, be removed by a pair of pliers, not by pinching off the superabundance, but by bringing it between the chops of the instrument, holding it lightly there, and then twisting the pliers slightly, so as to exert a degree of pressure upon the exterior edge of the glass by one of the sides, whilst the other merely serves as a fulcrum for support to the power. The edge will be found to splinter and crumble away under a force thus applied, and the art of successfully using it is soon learned by practice. This method is not so applicable to the edges of tubes as to straight glass, but may often be used with crown glass, when the file is inapplicable.

83. Glass may be ground on almost any flat stone with a coarse grain, by means of a little sharp sand and water, or, better still, by emery and water. Thus the ends of the tubes, (76) may be ground level, on a piece of Yorkshire or Purbeck stone. The operation is easy, in proportion to the smallness and thickness of the tubes. It requires that the glass should be held with a steady hand, and perfectly upright, that the resulting edge may be flat. Larger vessels, as jars, &c. may be ground in a similar way, but are better trusted to the instrument maker.

84. When a bottle requiring a stopper, has been fitted with one from the stopper drawer, (77) it may happen that, though nearly so, it is not quite true and tight. In such a case, the stopper may be made to fit accurately, by being ground with a little sea sand, or

coarse emery, and water, into the mouth of the bottle; during which operation, it should be quickly inserted into, and removed from its place, and turned at the same time. In this manner, the glass is in part worn away, and the stopper made tight; but care should be taken that during the grinding, the bottle be shifted a little now and then in the hand, that different parts of the neck and the stopper may work against each other at different times, and thus mutually correct the existing inequalities.

On the Combination of a Practical with a Liberal course of Education. By W. R. JOHNSON, *Principal of the High School of the Franklin Institute.*

No. VI.

NEXT in importance to the office of *teacher*, in the High School, is that of honorary monitor, or *tutor*. This post is, at present, generally assigned to those students, who, having been for some time members of the school, have exhibited the best character, the most regular attendance, and the greatest aptitude in discharging monitorial duties. They must have attained the age of fifteen years, have sustained a high rank in their classes, and must engage to remain at least one year from the time of their appointment.

The tutors are allowed to attend any branches of study pursued in the school, free from all charges for instruction. They enter the school room, by a private passage, and have access at hours when other scholars are excluded. Their accommodations for study, at separate tables, are superior to those enjoyed by ordinary scholars. For their movements about the building, they are allowed a certain discretion, compatible with the proper discharge of their duties, and with the confidence which they are found to merit. As unblemished integrity is required in those who become candidates for the office, so the treatment towards those who continue to sustain that character, is such as we accord to ingenuous young men, rather than to mere boys.

But as this is an office of much responsibility, any misconduct, remissness, or even indifference to duty, in the incumbents, is regarded as a more serious offence, than in any other class of students.

It is the duty of tutors, to be present at the opening and closing, as well as at all other hours of the school; to observe the conduct of scholars, and note all irregularities which may occur in the passages, or elsewhere, about the building. They assist in transferring the notes of monitors from the small slates on which they are kept, to the journals of the teachers, and at the end of each half quarter, copy the results, exhibited by those journals, into the register, and aid in making out the merit rolls. When required by the arrangement of classes, they act as division monitors, in any department in which they may be found qualified to give instruction. A *section*,

composed of two or more *divisions*, is sometimes committed, during a recitation, to the charge of a tutor, who examines both monitors and pupils, and reports to the teacher the result of his inquiries. While divisions are reciting to their monitors, the tutors render important services, by passing from one semicircle to another, and observing whether the prescribed methods be strictly adhered to. From their reports on this subject, and from his own observation, the teacher enters in his journal the credits deserved by the monitors for the discharge of their duties. When questions of importance concerning the conduct of scholars, happen to arise, or when disputes occur between students, the tutors, either by themselves, or in the presence of a teacher, examine witnesses, and report in writing, the facts of the case. Remarkable skill and manliness have sometimes been evinced in conducting these inquiries, and it is believed that they have seldom or never failed to elicit the truth.

The *class monitors* next claim attention. They are twelve in number, taken from the head of the merit roll. Their duties relate principally to matters of discipline, and are chiefly confined to the study room, where they are placed at desks somewhat elevated above the rest of the school, so as to command a full view of their respective classes. Each keeps a list of his class, on which he marks the absence and tardiness of its members, together with such notes of discredit for misconduct, as the teachers may direct. He likewise receives the certificates of excuse brought by the scholars of his class, from their parents or guardians, erases the marks to which they relate, endorses them on the back, and hands them to the principal, to be inspected and preserved. They are required to be particularly attentive to order at the time of opening and closing school, and are, in succession, appointed superintendents of order out of school, where they are charged to note all irregularities of conduct committed by scholars in the vicinity of the building, before and after the hours of instruction. They are, occasionally, appointed examiners to canvass the claims of different scholars who happen to be candidates for the same rank in a class or division. A certain number of credits is allowed to each class monitor, at the end of every half quarter, for the faithful discharge of his duties. This, with the distinction attached to the post, is, generally, sufficient to secure uprightness and punctuality.

The second twelve, from the head of the merit roll, are termed *adjunct monitors*, whose duties, like those of class monitors, relate wholly to the discipline of the classes, to the condition of the benches, desks, slates, books, pens, and all other utensils employed by their classes, and liable to be lost or destroyed through neglect or inattention. In the absence of class monitors, they also take charge of the class lists, and record the absence, tardiness, and misconduct of members.

The *ordinary, or teaching monitors*, are taken from those who excel in each branch, and who have, usually, made much greater proficiency in the subject, than the scholars over whom they are placed. In a few instances, however, especially where memory is

chiefly concerned, it has been found most advantageous to cause the monitor to learn the same lesson as his division, care being taken that he should know and understand thoroughly, the whole exercise, before going to his semicircle. Though the greater number of teaching monitors will, generally, be found among the *class* and *adjunct* monitors, yet the latter offices have no connexion with the former. The possession of the one, neither insures nor prevents the possession of the other. The number of pupils placed for recitation under each monitor, is from two to seven, and the number of monitors and divisions in each branch, varies, of course, with the number of scholars who happen to be engaged in that particular pursuit. In some branches, nearly twice as many scholars are taught immediately by masters, as are required to fill the places of monitors; so that in case of the absence of any monitor, a substitute can immediately be found. By this means, the powers of the monitor are, at the time of his appointment, perfectly known to the teacher, and all the acting monitors are far in advance of the divisions which they severally instruct.

ENGLISH PATENTS.

To Joseph Tilt, *Merchant, for improvements in the Boilers used for making Salt, commonly called Salt Pans, and in the mode of applying heat to the Brine. Communicated by a person residing abroad.* Dated April 4, 1827.

In the method first mentioned, in Mr. Tilt's specification, the salt-boilers consist of long cisterns of brick work, 30 feet or more in length, with double walls at a small distance asunder, between which, clays, or other substances impenetrable to water, are pressed down, so as to prevent the liquor from leaking through; and their bottoms are, also, made water-tight, in a similar manner. Within each of these cisterns, a hollow triangular prism of plate iron, is placed horizontally on one side, on a platform raised a small height from the bottom, and occupies its whole length, except a short interval at each end; but is so much narrower than the cistern, as to leave room for a long narrow trough, or succession of narrow troughs, being placed between its lower edges and the side walls. These troughs are only as high as the platform, so that they lie sufficiently low to receive the salt that will roll down from the inclined surfaces of the iron prism into them, as fast as it crystallizes, and drops on the iron plate, from its increased specific gravity.

It will be readily perceived, that the brine is to be heated by means of this hollow iron prism, and two methods are directed for this purpose; in the first of which, steam is employed, which is introduced into it from a steam boiler, of the common construction, by two tubes, that enter at one end of it, near the bottom, at the different sides of a low wall or partition, which runs lengthways in

its middle, from end to end, and whose chief office is, to sustain a coping, or projecting plinth, a small distance from the upper angle, to prevent the heat from operating too strongly in that part. Two other tubes proceed from the further end, to convey the steam either to operate in other salt pans, or by a chimney, into the open air; and a fifth tube runs out from it, close to the bottom, to carry off the water that will be formed by the condensation of the steam.

In the second method of applying the heat, a fire is made within the hollow iron prism, which, for this purpose, protrudes through the walls of the brick cistern, at one end, where it is furnished with furnace bars, and an ash receptacle, and with doors for the admission of fuel, and for the removal of ashes, similar to those used for the fire places of common boilers. The same longitudinal partition is used in this case, as before, so that, in fact, there will be two fire-places within the prism, or, what amounts to the same arrangement, the fire-place will be separated into two equal portions; a back of brick work is also raised at the end of the fire-place, a few feet within the boiler, and over this back, the flame and smoke pass to a large tube at the other extremity, which penetrates through the end walls of the cistern, and either conveys it off to act in producing evaporation in other boilers, or directly into a chimney.

The troughs before mentioned, which receive the salt as it falls down from the sides of the iron prism, when they are made the whole length of the cistern, are separated by partitions, into several square cells, in which the salt will be formed into lumps of a similar shape; and they may, also, be thus divided, when not small enough for a single lump of salt: in either case, they are perforated with numerous small holes, through which the water may drain out, when they are drawn up from the cisterns, after becoming filled with salt; and to facilitate this latter operation, cords are fastened to them, which extend upwards above the edges of the cisterns.

In describing the iron vessel within the cistern, as a triangular prism, we have varied somewhat from the original; which, by assimulating it to a roof, only implies that it has two sides; but in doing this, we think we have furnished a useful improvement to the patentee; as the sheet iron angular roof-like vessel would, with great difficulty, be made water-tight, or steam-tight, at its junction with the brick work, and would, after being used, be still very liable to leak in that part, an inconvenience to which the sheet iron prism would not be subject: and, in fact, the cavity within the cistern, which it produces, is, really, a triangular prism, as described in the original, but one of which the top of the brick platform constitutes one of the sides, or the base, instead of being entirely of iron, as we would recommend.

It is stated, in the conclusion of the specification, that several varieties of shape may be used, both for the cisterns, and for the iron roof-like heater; and, that the latter may, also, be made to constitute the bottom of a salt pan; while the former may be fabricated of several different materials, among which, wood is expressly mentioned.

In the figures that accompany the specification, the plate-iron heater is represented with angles of 60 degrees, and the level of the brine, as rising above it only a few inches. The subjoined wood cuts will, more completely, explain Mr. Tilt's invention.

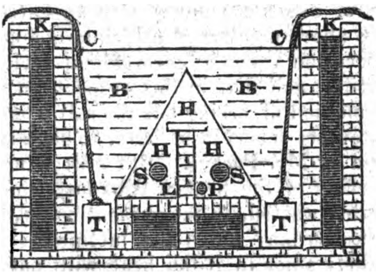
Fig. 1. Transverse section of the salt pan, as heated by steam.

B, B, Brick cistern, containing the brine.

H, H, H, Hollow iron roof-like heater.

S, S, Steam pipes entering into H, H.

Fig. 1.



P, Pipe for conveyance of water or condensed steam, from H, H.

T, T, Troughs for raising up the salt.

C, C, Cords for hauling up T, T.

K, K, Clay rammed between the double walls of B, B.

L, Brick partition in H, H, supporting a coping to equalize the heat.

Fig. 2.

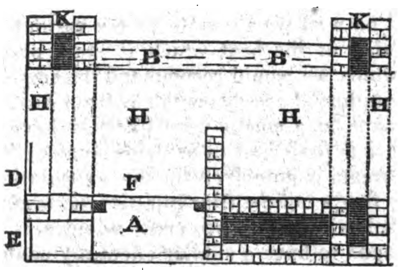


Fig. 2, Longitudinal section of the salt pan, as heated by a furnace.

B, B, Brick cistern containing the brine.

H, H, H, H, Roof-like heater continued through the double walls at each end of B, B.

D, Furnace door at one end of H, H.

F, Bars of the furnace fire-place.

A, Ash receptacle.

E, Door of A.

K, K, Clay rammed between the double walls of B, B.

Obs.—The principle used by the patentee, in his boiler, (of sloping its lower part, so that the salt may roll down off it into a recepta-

cle, according as it crystallizes and is precipitated,) has, before, been adopted by Mr. Josiah Parkes, in the salt boiler, for which he obtained a patent in December, 1823, (for which, see the 1st vol. of our present series, p. 281.) .

Several of the remarks, which we made on Mr. Parkes's boiler, will, also, apply to the present one, particularly, those relating to the probable insufficiency of the slope, or inclination of its lower part, to prevent *all* incrustation, on account of the great attraction which the earths of the earthy salts, that are contained in the brine, have for the iron of this part; but it also appears to us, that the mode in which the above-mentioned principle is applied in the present boiler, will occasion a much less waste of fuel, than that used in Mr. Parkes's boiler, and that in this respect, an improvement is effected; and the method of taking out the salt from the pans, used by the present patentee, seems to us, also, to be more advantageous than that employed by Mr. Parkes. But still it appears probable, that much of the effect of the heat will be lost, and, of course, the fuel be proportionably wasted, in the present boiler, by the great inequality of its distribution; which the inclined sides of the iron heater must occasion; since in it the heat will, naturally, fly up to the upper angle, and be proportionably diminished at the lower parts; an effect, which the partition wall and its coping, used by the patentee, will have little or no power in preventing, though designed expressly for that purpose.

That the slope at the bottom of the salt pan, (or of the part of the apparatus which performs the same function, under a different designation,) will diminish the incrustation, though it may not entirely prevent this evil, we think to be extremely probable, and that, therefore, it will be well worth while to try various methods to obviate the inequality of the heat which it must occasion, as above stated; among which we would recommend the employment of several parallel longitudinal flues, beneath the iron heater, each having a separate fire-place, as a means very likely to have the desired effect, when the fire is preferred to be made immediately beneath this part: but when steam is employed for the evaporation of the brine, it appears to us, that a hollow triangular prism, such as we have before recommended, whose bottom, as well as sides, is formed of plate iron, might be made to have a similar effect, by confining the steam within it, by a loaded valve, so as to make it act under a pressure.

[*Repertory.*

To Charles Pearson, Esq. Richard Witty, *and* William Gillman, *Engineers, for their having invented a new or improved method or methods of applying heat to certain useful purposes.* Enrolled June, 1827.

The specification of this patent has no drawing attached to it, as no specific form or arrangement of parts, is claimed; but the

invention, in its broadest latitude, applies to the heating of every kind of boiler.

The peculiar feature of novelty proposed, is the construction of a descending flue, under a boiler, the bottom of the boiler being bevelled, or formed as an inclined plane. The object of this contrivance is, that the greatest intensity of heat from the furnace, (which will be at the commencement of the flue, at the top of the inclined plane,) shall act against the shallowest part of the water in the boiler, and thereby generate steam with great rapidity, from the surface of the water; whereas, in ordinary boilers, the heat has to pass through the whole mass of the water.

A mode of applying this principle, is proposed in the construction of a tube boiler. The tubes are to be placed horizontally, and ranged side by side, gradually rising, one above the other, upon a suitable inclination. They are to be combined, by means of lateral boxes or tubes, leading from one to the other, at the ends, by which arrangement, the water will be enabled to flow through the whole range.

A force pump is applied, for the purpose of injecting water into the boiler, at the lower tube, from whence it gradually rises through the range, as it acquires heat, and passes off at the top, in the form of steam.

Another proposition is, to form the boiler with ledges, one rising above the other; but the precise method of doing this, we do not exactly understand. It is sufficient to say, that, in whatever way the boiler is constructed, the descending flue is the novel feature of the invention, which, it is considered, will cause the whole of the heat to be taken up by the water; or, at least, the greater part of it, and to generate steam in the boiler, with greater rapidity and economy, than upon any other plan. [*Lond. Journ.*

To JAMES FRAZER, *Engineer, for his Invention of an Improved method of constructing Capstans and Windlasses.* Enrolled July, 1827.

THIS purports to be an improvement upon a patent, dated February 25th, 1826, for a method of constructing capstans and windlasses.

The present improvement consists in forming two rows of capstan bar holes, for the insertion of capstan bars; one row of the holes being in the neck of the capstan, the other in the drum-head. The holes are to be slightly inclined, from the horizontal, the upper row tending downwards, the lower row upwards, so that the outer ends of the capstan bars, inserted in either of the rows of holes, shall range in the same line, for the convenience of being more readily worked by the men.

Within the upper part of the capstan, toothed gear is to be introduced, for the purpose of enabling the capstan to be worked with increased power. The diameters of the wheels and pinions, and the number of teeth in each, may, of course, be varied at pleasure, as set forth in the former specification above alluded to.

This contrivance is to prevent the necessity of pins or clutches, to fix or disengage the gear; for when the capstan is to be worked, by the ordinary power exerted by the men, the bars are to be inserted into the row of holes in the neck of the capstan; but where an additional power is required, then the bars are placed in the holes of the drum-head, and being worked, the barrel of the capstan will be driven round by the toothed gear.

The same contrivance is, also, applicable to a windlass, and may, it is said, be adapted in a very simple way, but the patentee has not shown drawings of the mode. [*Ib.*

To James Frazer, *Engineer, for his Improved method of constructing Boilers for Steam Engines.* Enrolled July, 1827.

It is proposed, as the subject of this patent, to surround the boiler of a steam-engine, with a jacket or outer case, leaving a space of about three inches between that and the boiler, which space is to be occupied with water, up to the level of the water within the boiler.

The intention of this outer vessel of water, is to prevent the bottom of the boiler coming in contact with the wood-work on shipboard, and, consequently, rendering it much more safe for steam vessels, than the usual construction of boilers are.

In order to assist in heating the water in the outer vessel, the flue from the furnace within the boiler, is to be compressed into a tube, and carried down, and passed through between the boiler and its jacket, which tube being encompassed by the water, will, by that means, communicate a great additional heat to the boiler, or, in other words, take up that heat which would, otherwise, pass off without advantage. The generating of steam being, by these means, promoted, and the fuel, consequently, economized. *Ib.*

To James Woodman, *Perfumer, for his having invented Improvements on Shaving and other Brushes, which Improvements are also applicable to other purposes.* Enrolled September, 1827.

This improvement, as it applies to shaving brushes, consists in forming a tube or recess in the handle of the brush, which is to contain soap or shaving paste, and whenever a supply is wanted, a small pin, or sort of piston, is pressed down into the recess, which forces a quantity of the soap or paste through the back of the brush, in among the hairs.

The soap is by that means introduced into the brush, and is brought into use by dipping the hairs into water, and then rubbing them upon the face.

The form of the brush is of no consequence, nor the quality of the hair, whether it be made of bristles, badger's hair, or camel's

hair; the invention being the recess for holding the soap in the handle, and the hole through which it is passed into the hairs by a sliding pin or piston, as described.

The same construction of brush, is applicable to holding oil or any other material, and even to painting brushes; but in that case, the hole through which the oil or paint passes, must be covered by a valve, otherwise the liquid material would flow out too rapidly.

Scrubbing brushes, extract brushes, nail brushes, and a variety of other kinds of brushes, may have soap introduced into the back or case, in which the hairs are fixed, and it may be forced through small holes into the hairs, as occasion may require. [*Ib.*

To Robert More, *Distiller, for improvements in the process of preparing and cooling Worts or Wash from Vegetable Substances, for the production of Spirits. Communicated to him by a Foreigner.* Dated July 18, 1827.

To all to whom these presents shall come, &c. &c.—*Now know ye*, that in compliance with the said proviso, I, the said Robert More, do hereby declare the nature of the said invention to consist, first, in preparing worts from grain, or the like vegetable substances, mashed in the state in which it comes from the mill stones, in a vessel without a drainer bottom; and, secondly, in cooling worts or wash, for the purpose of fermentation, by the addition of water at a low temperature. And in further compliance with the said proviso, I, the said Robert More, do hereby describe the manner in which the said invention is to be performed, by the following description thereof, (that is to say,) first, of the said improved process of preparing worts, which is as follows: I place all the grain, or other like vegetable substance that is to be used, in the state that it comes from the mill stones, with all the husky matter with it, in a vessel without a drainer bottom, and mash it in such vessel, whereby I am enabled to use grain yielding a better quality of spirit than in the ordinary mode; the whole mixture, after being cooled down in manner hereinafter described, as the second part of the said invention, is then to be fermented together, and in that state, with the husky matter in it, and when the attenuation is completed, sent to the still in order to the separation of the spirits from the wash.

And secondly, of the said improved process of cooling worts or wash, which is performed by the addition of such a quantity of water, at a low temperature, immediately before the addition of yeast in order to fermentation, as is requisite to reduce the temperature of the whole to that best adapted for fermentation, which is known to practical men, and depends on the density of the worts or wash to be fermented; by this method, there is not only a great saving in the expense of utensils usually employed in cooling distillers' worts or wash at present, but the process is, thereby, accelerated, and may thus be most successfully completed.

Now, whereas I do not claim the use of a vessel without a drainer bottom, generally, but I claim as the said invention, first, the process hereinbefore described, of preparing the worts, namely, from grain or other the like vegetable substances, put into a vessel without a drainer bottom, with all the husky matter, just as it leaves the mill stones, and mashed in that state in such vessel; and, secondly, the process hereinbefore described, of cooling worts or wash, and such the said invention being, to the best of my knowledge and belief, entirely new, and never before used in that part of his said majesty's United Kingdom of Great Britain and Ireland, called England, his dominion of Wales, or town of Berwick-upon-Tweed, nor in any of his said majesty's colonies or plantations abroad, I hereby declare this to be my specification of the same, and that I do verily believe this my said specification doth comply in all respects, fully and without reserve or disguise, with the proviso in the said hereinbefore in part recited letters patent contained, wherefore, I hereby claim to maintain exclusive right and privilege to the said invention.

In witness whereof, &c.

OBS.—In Jonas's Distiller's Guide, page 13, it is stated, that the Dutch distillers ferment the *whole* of their malt, mixed with rye meal, into a wash, and pour *husks* and all together, into the still, for the extraction of the spirits: and, as this book was published many years ago, it is evident that the introduction of the first part of the process above-mentioned, into this kingdom, was so many years prior to the date of the present patent: and as to its second part, comprising the method of cooling the wash, since cold water cannot be added to it without diminishing its strength as well as its temperature, either the portion of hot water first poured in must be considerably less than that usually allowed in mashing, as being the best for the extraction of the soluble parts of the grain, or the wash must be more diluted than what experience has determined to be the proper degree for producing the greatest proportion of spirits: unless the distillers, hitherto, have been so much inferior to the patentee in judgment, science, and experiment, as to have now to take lessons from him on those important points, after, we may say, the accumulated experience of centuries, and the expenditure of infinite capital.

The process seems to us well calculated for the advantage of illicit distillers, as it will save them the first cost of numerous vessels, and enable them to carry on their operations in so much smaller compass, as will considerably facilitate concealment: which advantages would, probably, pay well for an inferior produce of spirits, if this should occur, either from the over dilution, or insufficient hot infusion above-mentioned, according as either might predominate.

[*Repertory.*

To Joseph Blades, *Gentleman, for an improvement in the water proof Stiffening for Hats. Communicated to him by a Foreigner residing abroad.* Dated 15th January, 1828.

To all to whom these presents shall come, &c. &c.—*Now know ye*, that in compliance with the said proviso, I, the said Joseph Blades, do hereby declare the nature of the said invention, to consist in causing the stiffening of hats to be accomplished by means of gum shell lac, dissolved in alkali, instead of spirits, applied to the hat body, and, afterwards, hardened, or set by diluted acid; and in further compliance with the said proviso, I, the said Joseph Blades, do hereby describe the manner, in which the said invention is to be performed by the following description thereof, (that is to say;) take eighteen pounds of gum shell lac, one pound and a half of salts of tartar, and five gallons and a half of water, or the like proportions of greater or less quantities of the mixture, reserving part of the water to put in when likely to boil over: put these three articles into a kettle over a fire, and boil them gradually until the gum is dissolved, say for about an hour, stirring the whole towards the last. The period of perfect solution, may always be known, by the whole boiling up as clear as water, without any scum on the top; if left till it is cold, there will be a thin crust on the surface, of a whitish cast, mixed with the dirt of the gum, which must be taken off. Dip the hat body into the mixture, in a cold state, so as to absorb as much as possible of it, or apply the mixture by a brush, sponge, or other means, and then draw the hat body off on the plank with a stamper, using a light or heavy hand, according to the stiffness required; the hat body being thus stiffened and drawn out, may stand awhile till dry, or nearly so, then having brushed it over with a hard dry brush, to clean it, immerse it in diluted acid, or water made acid in the following manner: say to five gallons of cold water, put half a pint of vitriolic acid: soak the hat body for about five minutes, when the gum will be set. If they are not to be napped immediately, they may be thrown into a reservoir of pure water, using them as wanted. If the hat bodies have been made in vitriol, soak them in hot water to kill the acid, and dry them before you attempt to stiffen by the above described process, and be careful not to drop water on the stiffened bodies before they have been in the acid water. When stiffening great quantities, be particular to keep your acid water up to the strength laid down as above directed, adding more acid when you find, by applying the tongue, that from repeated immersions, the alkali has somewhat weakened the power of the acid.

The invention which I claim under my hereinbefore in part recited patent is, therefore, the new process of water-proof stiffening for hats, by dissolving the gum shell lac in alkali, instead of spirits, and setting or hardening the said gum, after it has been introduced, as aforesaid, into the body of the hat, by neutralizing it in weak or diluted acid, as above described, and for this purpose, I mention and describe gum shell lac as the gum, salts of tartar as the solvent,

and vitriolic acid to neutralize the same, because I have used these materials, and found them to answer the purpose; but, at the same time, any other alkali that will act as a solvent to the gum that is used, and any other acid that will set such gum, or neutralize the alkali, may be used; and I therefore include their use as part of my aforesaid invention, the object of which is, to produce hats without the use of spirits or essential oils, which have before been used in the manufacture. [*Ib.*

Notice by the Editor.—The foregoing patent, it will be seen by the heading, was taken out as communicated by a foreigner. The invention is American, a patent having been taken out for it by Stephen Hempstead, jr. Charles county, Maryland.

To PETER BURT, *Mathematical Instrument Maker, for an improved Steam Engine.* Dated 4th August, 1827.

THE working cylinder of Mr. Burt's steam engine, is suspended near the top, on two hollow gudgeons; the piston-rod issues from its lower extremity, instead of being in the usual position, and its extremity acts immediately on a crank in the horizontal axle of a fly-wheel, without any connecting bar being interposed, according as it is represented in the drawing, but it may be jointed to the end of a working beam, also, in a similar manner. From this arrangement, the cylinder vibrates backward and forward, on its hollow gudgeons, the perforation in one of which enters into its upper part, while that of the other communicates with a tube that passes down along its side and opens into its lower extremity. The steam, of course, is conveyed through these passages, alternately, to the different ends of the cylinder; and a figure is given, of a method by which this may be effected, by a single D valve, which, also, opens a communication with the condenser, and that end of the cylinder from which the steam is shut off, while it admits it to its other extremity. This valve is situated in the middle of a semi-annular pipe, placed horizontally, the ends of which join the terminations of the hollow gudgeons, at the opposite sides, by a joint shaped in the section of a cone; and iron straps being passed round the ends of this pipe from the gudgeons, screws placed in their centres in the direction of the latter, compress the conical ends of both together, so as to make the joint impervious to steam. The hollow gudgeons work in brass sockets, sustained by upright pillars that form part of the frame-work of the engine. The joints which connect the pipes and gudgeons are made of bell-metal, and all the other parts of the engine are formed of cast-iron, but the piston-rod and valves, which are constructed of the usual materials. No farther directions are given

respecting the valves, than those we have mentioned, except that it is stated, when large engines are employed, a separate valve is to be used for each of the hollow gudgeons.

Obs.—About four years since we saw, at Dock-Head, a vibrating cylinder, used in a steam engine, which had been erected some time; and was, we were informed, the invention of Mr. James Neville; though we have since heard that engines of this sort were erected previously, in the vicinity of Liverpool; but of which, however, we cannot speak from our own knowledge.

The engine at Dock-Head, had its hollow gudgeons placed about the middle of the cylinder; its piston-rod passed out at top, in the common direction, and the hollow gudgeons were contrived, so as to act like cocks, in admitting or shutting off the steam, and in opening or closing the communication with the condenser; which latter ingenious invention, very much simplified the machinery, since the mere vibration of the cylinder, opened and shut the communications, as perfectly as the most complicated valve apparatus.

Now, as in Mr. Burt's engine, this last contrivance is not employed, we can perceive nothing in it that can compensate for the additional parts necessary for the steam-tight joints and other indispensables at the gudgeons, so as to give it any advantage over a common engine, since the mere saving of the connecting bar between the piston-rod and the crank, or the beam-head, evidently, cannot have this effect; and we should think it very unjust towards any patentee, if the mere alteration of the position of an engine, as in this case, would permit another person, by such a simple variation, to evade the patent-right. If such an evasion were allowed, a patent for a pocket chronometer might be defeated by another for placing the very same machine on a table, in a horizontal, instead of a vertical position, which it would assume in the fob; and the patents for numerous other engines, might, also, be rendered nugatory, by similar means; we are, therefore, inclined to think, that the validity of Mr. Burt's patent is affected, by the patent previously obtained by Mr. Neville; since the alteration of the direction of the piston-rod, is the only material difference between the engine described in the specification of the former, and that employed by the latter gentleman. [*Ib.*

To Joseph Maudslay, Esq. *for improvements on Steam Engines.* Dated 1st August, 1827.

Mr. Maudslay's steam engine, for which this patent was obtained, is of the oscillating sort, the gudgeons of which are placed near the middle of the opposite sides of the cylinder; and one of them being hollow, passages are formed through it, and through the

side of the cylinder, to the two extremities of the latter, into which passages the steam is admitted successively, while the communication with the condenser, is opened to that one of them from which the steam has been turned off. These alternations are effected, by means of a D valve, that operates in a peculiar manner, but which, from the imperfect and inadequate description in the specification, we have been unable to comprehend.

The whole engine is sustained by two triangular frames, placed vertically, a little more than the breadth of the cylinder apart; in bars placed across which, at a proper height, the gudgeons work, while the crank axle, to which the fly-wheel is appended, turns in their upper angles in a horizontal position, and carries, also, an eccentric wheel that works the D valve.

The air-pump in this engine, is represented of an unusually large size, and is moved by a crank of small depth, formed on the last-mentioned axle beyond one of the triangular frames; which causes the stroke of its piston to be much shorter than that of the main cylinder's piston.

The chief differences between this engine and the oscillating engines before constructed, are stated by the patentee to consist, 1st, in the general arrangement of the parts; 2ndly, in the form of the frame by which it is supported; 3dly, in the construction of the D valve and valve-box slide; 4thly, in the eccentric wheel that moves the D valve; and 5thly, in the passages which convey the steam along the side of the main cylinder, to its two extremities; and it is asserted, that the engine possesses the advantage of being less in weight, in proportion to its power, than common engines, of occupying less space, and of costing less in materials and workmanship.

OBS.—We cannot perceive any material superiority of this engine, over other oscillating engines that we have seen, which possessed all the advantages that the patentee has enumerated, as appertaining to his engine, nor, indeed, does there appear much difference between them, except in the disposition of the valves for regulating the communications between the main cylinder, and the boiler and condenser; which, in point of simplicity, at least, was exceeded by an engine of this sort, constructed by Mr. James Neville, which we saw at Dock-Head, about four years ago, and which we have noticed in our observations on Mr. Burt's engine, in the preceding article.

In the specification of this patent, no verbal description of the parts of the engine is attempted; and nothing more is given, than a reference to the drawing annexed to it, which consists only of the mere outlines of plans and sections; in which those of the frame and of the different parts of the engine are so intermixed, as, in some parts, to be unintelligible to any persons, perhaps, but those who were concerned in its construction; and this, unfortunately, happens to be so much the case in the part relative to the D valve, in which the chief distinction between this engine, and others of the same sort, lies, that we own our inability to comprehend it.

We do not mean to censure the use of outline drawings on all

occasions, considering them very sufficient for most subjects of a simple nature; but when complicated figures are to be represented, and sections of tubes, cylinders, and other apparatus, some parts of which are hollow, while others project in various degrees; and where several portions of an engine cross others in numerous directions and at different distances, we think mere outlines quite inadequate to produce fair and distinctly intelligible ideas of the objects; especially when they are unaccompanied by full explanations. [*Ib.*

An Essay on Calico Printing.

[Extracted from Parke's Chemical Essays.]

[CONCLUDED FROM PAGE 295.]

Begging to be excused for the irregularity of the preceding digressions, I must not forget to revert to that other kind of discharge-work, which I have engaged to describe, and which I will now attempt, as concisely as is consistent with perspicuity and correctness.

Here, the agent which is employed, is the citric acid, and this is used in various states of concentration, according to the purpose to which it is to be applied, and the strength of the ground intended to be discharged. It is chiefly employed, for the production of white figures upon self-coloured grounds, produced by madder and sundry other dyes. For this intention, the acid, in whatever state of concentration it may be, is mixed with either gum, or with flour-paste,* to a proper consistency for the block, the plate, or the cylinder, and from thence it is transferred to the piece; and wherever it attaches, the mordant, whether iron or alumine, is discharged, and a delicate white arises in its stead.†

The acid here referred to, is produced from the juice of limes or lemons; and, formerly, it was not employed by the calico-printer, until it had been reduced to the utmost point of concentration, and appeared in a crystalline form. Even then, it was not thought sufficiently pure, but was dissolved again, and redissolved and recrystallized, until it became as white and pellucid as any other pure salt in a crystallized state, and was then, generally, sold for 36*s.* the pound, at which high price, it could only be employed on the best styles of work. Now, however, it is oftener used in the brown, or first state of crystallization; and some of the larger printers purchase lime juice, and concentrate it themselves; and in many cases they use it largely, both for discharge and resist-work, without crystallizing it. More on this subject may be seen in the Essay on Citric Acid, which was written with the hope of rendering an essen-

* When citric acid is used for resist-work, it is always mixed with gum senegal and pipe-clay. The clay gives it a greater body, and, likewise, acts mechanically as a resister.

† It should be understood, that the discharge is printed upon the mordants before the goods are dyed. In using citric acid for this purpose, a portion of one of the mineral acids is, sometimes mixed with it.

tial service to a large body of manufacturers, in various parts of these kingdoms.

This mention of discharge-work, by citric acid,* reminds me of another species of discharge, which is employed by the printers of Bandana handkerchiefs, and which I am under the promise of noticing, before I conclude this essay.

The agent which these printers employ, is the nitrous, and sometimes the nitro-muriatic acid. It is used for the purpose of putting yellow figures upon blue silk handkerchiefs. The following is the process which is principally adopted.

Aqua-fortis, or nitro-muriatic acid, of such a strength as is suitable for the kind of blue which is intended to be discharged, is mixed either with gum tragacanth, or with flour-paste, to a proper consistence, and in this form it is printed on the silk, by means of a common block, on which the intended pattern is cut. The consequence of this is, that wherever the acid attaches, there the original colour is discharged, and a yellow dye is produced in its place. The pieces are then steamed, by passing them over a vessel containing boiling water, which gives brilliancy to the colour, and finishes the operation.

If a stronger dye than the usual yellow, or even a deep orange be desired, all that is necessary is, to immerse the goods, for a moment, in lime water, or in a solution of lime and potash; and by varying the proportions of these ingredients, a great variety of shades may be produced.

It must be noticed, that this method is applicable only to the discharge of the colour from *silk* handkerchiefs; the process for producing the spots on *cotton* Bandanas, being entirely different. This manufacture, which is of considerably more importance than the former, was established some years ago, in Scotland, for the purpose of producing imitations of the Bandana handkerchiefs, which are imported from India. It is conducted in the following manner.

Pieces of fine calico, are dyed by the Turkey-red process, of a colour as nearly approaching to scarlet, as can be produced on cotton, by that means; and, upon this plain dyed calico, white spots are produced, by a method to be described hereafter. The pieces of calico, having been bleached to a perfect white, before they are dyed Turkey-red, the present object is, not only to discharge the dye on certain parts of the cloth, but, by the same agent, to restore those parts to their original whiteness.

These discharged parts, are, usually, in the form of spots, sometimes round, and sometimes square or triangular, and these marks or spots are produced, by the action of a chemical liquid, while the pieces of calico are under the action of a powerful press. The machinery for this purpose, is made in an expensive manner, as it is

* Mr. Thomson, a scientific printer, who has an establishment near Clithero, which is carried on under the firm of Thomson and Chippendale, has taken out a patent for discharging the Turkey-red dye by means of the citric and oxymuriatic acids; and the work executed in this way has a very pleasing effect.

required to be of very great strength, and it is put together with the utmost exactness.

To this press, two horizontal plates are adapted, for the purpose of receiving the calico which is to be placed between them. The pattern intended to be given to the handkerchiefs, is first marked upon these plates; and in the bottom plate, holes are cut of the exact form and size of the intended spots; whereas, in the upper plate, every spot is marked out by a small copper tube, which goes through the plate, and is firmly cemented within it.

When the plates are about to be fixed, there is a contrivance for ascertaining that the orifices of the tubes, in the upper plate, are exactly perpendicular to the respective holes in the under plate; which is a circumstance of the utmost importance, as the discharging liquor, which is poured into the tubes, is designed to pass through the folds of calico, into the corresponding holes in the lower plate.

The apparatus being thus prepared, the handkerchief pieces are neatly folded into squares, of the size of a single handkerchief, and of the thickness of about ten or a dozen folds. One of these pieces, consisting of ten or twelve handkerchiefs, is then laid smoothly upon the lower plate, and is so disposed as to lie square with the plate. By means of a lever, the cover of the press, to which the upper plate is attached, is then lowered, and by continuing the action of the lever, these plates, with the folds of calico between them, are screwed firmly together.

The consequence of this is, that the ends of the tubes fixed in the upper plate, are brought to press upon the surface of the cloth; and as these are made to press upon it with great force, and as each tube has a corresponding hole immediately beneath it, in the under plate, it is evident that the fluid which is poured into these tubes, will be directed into the holes below, and cannot pass in any other direction.

When things are thus arranged, and the press is firmly screwed down, a very dilute solution of chloride of lime, containing a small portion of sulphuric acid, is poured upon the upper plate of the press; and, as this plate has an iron rim round its upper surface, the fluid which is poured upon it, is determined into the tubes, and as it percolates through the cloth, it discharges the colour on those particular parts, and passes off through the holes of the lower plate into a trough, placed underneath to receive it.

It is observable, that the chemical liquid is prepared sufficiently strong, to discharge the colour in the course of about ten or twelve minutes, and yet not so powerful as to endanger the fabric of the cloth; and that the great pressure of the screw prevents the fluid from spreading beyond the precise limits marked out by the tubes and the corresponding holes underneath.

As soon as the discharging liquor is found to have entirely passed through, the press is slackened, and the cloth is removed to make room for another piece, which is immediately substituted; and in this way the process is continued throughout the day, without interruption. One press, requiring the attention of two men only, will

print fifty pieces, containing one dozen handkerchiefs each, in the course of the day.

When the pieces are first taken from the press, the spots which have been produced by the discharging liquid, are not perfectly white; it is, therefore, necessary to have recourse to a subsequent process, similar to the one usually employed for clearing the whites on common printed calicoes; and this not only removes every stain, but, also, heightens the brightness of the Turkey-red dye. I am aware, that at one time, there was a general complaint of such handkerchiefs, after frequent washings, becoming tender in those parts which had been acted upon by the chemical liquor: this, I think, must be owing either to the employment of a liquor too much concentrated, or to the remains of the acid not having been perfectly removed before the goods were dried and pressed for sale; as I am persuaded, that, with due caution, the process may be safely conducted.

When speaking of yellows, it was my intention to have mentioned, that there is a mode of producing yellows on calico, which is not very frequently practised, and yet has a very good effect. The process is as follows:

A strong decoction of quercitron bark, thickened with gum tragacanth, is to be mixed with a portion of very pure muriate of tin, and this, when printed with the usual management, will produce a colour of great brightness and durability. I mention this the rather, because very many pleasing effects may be obtained by this method, which cannot be produced in the usual way, by means of the acetate of alumina, and any of the yellow dyes that may be employed with it.

There is one very important advantage, which this mode possesses, viz. that should it be necessary to pad a piece in diluted acetate of alumina, to obtain a pale lemon ground, the yellow figures, previously imparted by the above process, will not give out any part of their colour to the second mordant; whereas, whenever a strong yellow has been produced in the common way, the pattern is very apt to spread and become irregular, and oftentimes to stain the white ground, when the piece comes a second time into the acetate of alumina.

The most expensive kind of calico-printing, called CHINTZ-WORK, still remains to be described. The term, chintz-work, is descriptive of that kind of calico-printing, which is employed for window-curtains and other furniture, and it differs more in the richness and variety of the colours, than in any other circumstance.

In relating the processes by which these beautiful prints are produced, I shall suppose the calico to be already properly bleached and smoothed, ready to receive the impressions of the block. The first thing then to attend to, is to apply the mordant for the colour which is intended to be imparted in the first instance. Thus, if a black be designed, a mordant of acetate of iron, commonly called iron liquor, is thickened with gum, and printed upon the cloth in any pattern that may have been selected for the purpose. If this same mordant be diluted with water, it will form a proper mordant for a

purple; and the same, still further diluted, will, when it comes into the dying-copper, form a lilac. In this way, all the varieties of shades, from a pale lilac to a strong purple, and from a purple to a black, may be produced by acetate of iron diluted with various portions of water, and then dyed with madder.

In like manner, a colourless solution of acetate of alumina, thickened with gum or flour-paste, forms a mordant for dark red; if diluted with water, it makes a common red; and by diluting it further and further, every shade of pink may be produced. Again, by the admixture of acetate of iron and acetate of alumina, a mordant for chocolate colours, maroons, &c., is formed, either approaching to the purple or the red, according to the admixture; that is, according to the proportion of either of these original mordants, which may predominate in the mixture.

When these several mordants have been printed upon the calico, they are allowed to dry for two days or more in a stove, or drying-house; they then go through the operation of dunging, which consists in rinsing them in warm water, in which a little cow-dung is diffused, as has been already described. When the pieces are sufficiently dunged, which is not the case till all the superabundant mordants are removed, they are well washed in clean water, and then boiled in a decoction of madder, until the madder-bath is exhausted. In consequence of different mordants having been applied to the cloth, this one boiling in the madder-liquor will at once produce all the colours above-mentioned. When the pieces are thus dyed, they are to be rinsed in cold water, and laid upon the grass to bleach. By this exposure to the air, for a few days, the whole of the ground to which none of the mordants had been applied, will become perfectly white.

The processes which have now been detailed, will produce what is called *common* chintz-work; but if it be desired to make the goods still richer, by the addition of yellows, bright olives, drabs, &c., the cloth must undergo another series of operations, which may be thus described:

Upon those parts of the calico which still remain white, any of the above mordants may be printed, according to the effect designed to be produced; after which, all the preceding managements are to be repeated, except that instead of boiling in a decoction of madder, they are to be immersed for about half an hour, more or less, in a warm decoction of quercitron bark, (the *Quercus nigra* of Linnæus,) a most important dye-wood, introduced by Dr. Bancroft, and which is found to give out a much brighter colour to *tepid* water, than it does when treated with *boiling* water, or with water nearly approaching to that temperature.

The effect produced upon these prints, by an immersion in a luke-warm decoction of this American bark, will be quite different from that produced by the madder; upon those parts of the cloth where the mordants have been printed, which before produced a black, a dark olive will only be apparent; and instead of pompadours, will be drabs, and instead of reds, we shall have yellows, which will

vary in intensity, according to the strength of the aluminous mordant.

Again: a further variety may be given to these prints, if the yellow mordant, or acetate of alumina, be applied to any of the colours which have already been dyed with madder; but this must be done before the pieces are immersed in the decoction of bark. This application will convert the reds and pinks into different shades of oranges, and the lilacs into cinnamon colours. By means of these different processes, an endless variety may be given to the goods, and a calico-printer of taste, will never be at a loss how to produce a pleasing effect, whatever may be the patterns which he has to imprint upon the cloth. The second immersion in the dying-vessel will, however, give a yellow tinge to the remainder of the whites, but a short exposure on the grass will obliterate it.

When chintz-furniture-prints are designed to have as much variety of colouring as possible, a part of the remaining white is often coloured blue or green, or of any shade between those colours, by a still different process. This is done with what is called pencil-blue, which is a preparation that has already been described. The blue is given, by putting in the prepared indigo with a pencil; and the green is produced by pencilling some of the same colour, over certain parts of the pattern, which has already been dyed yellow.

When these colours have been imparted, the printing is said to be finished, and the pieces are hung up to dry, for at least twenty-four hours; after which, they are rinsed thoroughly in cold water; and when they have been dried with care, they are properly calendered and put up for sale.

Nothing now remains, but to notice an improvement, which has been made of late years, by the introduction of CYLINDER-PRINTING, which has the advantage of superior accuracy and neatness, as well as of great expedition.*

The machines which effect this, are rather complicated, and very expensive; but some kind of work cannot be produced at so cheap a rate, by any other means. They are so contrived, that the cylinders on which the patterns are engraved, furnish themselves with the prepared colour during their revolutions; their surfaces are kept clean by a steel knife, or *doctor*, as it is called, passing over them the moment they have charged themselves with the thickened colour; and they have such a pressure given to them, either by means of screws or levers, which can be tightened or slackened at pleasure, that the whole cylinder is made to deposit its colouring matter with the greatest certainty and exactness on the cloth, while this rolls over it in succession, from one end of the piece to the other.

These cylinders, which are made of copper, are from eighteen to forty-two inches in length, according to the width of the calico to be printed, and from three and a half to five inches in diameter;

* A variety of observations on the printing of calicoes by means of the cylinder, which may be read with advantage, in connexion with this essay, will be found in Nicholson's 4to Journal, vol. i. page 18.

and these massy rollers have the patterns enchased upon their surfaces, in the same way as a pattern is cut upon a flat plate of copper, that is intended to be employed in copper-plate printing.*

Many of these machines are contrived, so as to carry two of these cylinders, each of which has a trough of colour attached to it, by which means two different colours may be printed on the same calico, at one and the same time; and Mr. Adam Parkinson, of Manchester, has invented a machine capable of printing, at one time, by means of one cylinder, and two surface rollers, or by two of the former and one of the latter, three distinct colours.

These machines have not only the excellence of printing more correctly than can possibly be done by means of the block, but the saving of time and labour which they afford, is great indeed. A piece of calico, which would take a man and a boy three hours to print with one colour, or six hours to finish with two colours, may, by this means, be printed in three minutes, or three minutes and a half, and the work will be much more completely done than could even have been imagined, before the introduction of this invention.

Besides these cylinders, there are others, which are called SURFACE-MACHINES, which contain cylinders, not of copper, but of wood, and which have the pattern formed upon their surfaces in relief, exactly similar to the blocks described in page 174. These are employed in particular styles, especially on light grounds,† and for certain kinds of resist and discharge-work.

It must be obvious to every one who is acquainted with the subject, what an astonishing facility these machines must have afforded to the production of printed calicoes; and, also, what an advantage they give to the British printer, in foreign markets.

Information and Prospectus respecting the Fecula of the Sweet Potato. Being a continuation of the article on that subject, in the 5th volume of the Franklin Journal; communicated by G. G. BARRELL, ESQ. *Consul of the United States, at Malaga.*

Boston, October 2, 1828.

MY DEAR SIR,—I have recently received a canister of the fecula of the sweet potato, from G. G. Barrell, Esq. consul of the United States, at Malaga, with an account of its use, other than as starch,

* As these cylinders are made with plates of copper hammered into a circular form, and joined by brazing, great loss has, sometimes, been sustained by the engraving giving way upon the brazed joint. To obviate this, a patent has been obtained, for boring the copper cylinder from the solid metal, in the modern way of boring cannon.

† In light work, the white grounds are apt to be soiled by the cylinders: hence, surface-machines were contrived, and these are not liable to the same objection. Cylinder-machines are more commonly employed, in those styles which are full of colour, and leave but little white.

with a request, that experiments may be made of it, by some of the medical faculty; and as a sample was sent to the Massachusetts Hospital, for the same purpose, I have concluded to forward that sent to me, to the directors of the Pennsylvania Hospital, with a request that they will be so kind, as to publish their opinion of its use in the Medical Journal of the city, or the Franklin Journal. As the account of the mode of extracting the fecula, which I received from Mr. Barrell, appeared in the Franklin Journal, I should like to have the prospectus I enclose, inserted in that useful work, whether it is printed with the result of the experiments, at the Hospital, in the Medical Journal or not.

As Mr. Barrell has evinced a commendable zeal to be useful to his country, it is but just that his good deeds should be known.

If doctors Physick and Chapman are not connected with the hospital, I desire that some of the fecula may be given to them, with the hope that they will try it, and give their opinion of its utility, for the purposes named in the prospectus, which please to have copied and presented to them.

With sincere respect and great esteem,
your most obedient servant.

GERARD RALSTON, ESQ. (*Signed*) H. A. S. DEARBORN.

Prospectus of the Fecula of the Sweet Potato.

This most useful discovery, has taken place in Malaga, the only part of this hemisphere where that admirable production of the earth, characterized by Linnæus, *Convolvulus Batata*, class 5, order 3, of the Convolvulus family, is to be found; and has been rewarded by his Catholic majesty with a patent of invention. This fecula, extracted without fermentation or putrefaction, and for that reason wholly free from acidity, has been, scrupulously, analyzed by some of the most able professors in pharmacy, commissioned for that purpose; who have unanimously pronounced it superior to Sago, Tapioca, or any farinaceous substance, hitherto discovered, without excepting the celebrated plant, known by the name of *Galanga Arundinacea*, or arrow root, from the extreme whiteness, suavity, and fineness of the molecula which compose it, (visible only by the help of the microscope) from its most digestible and nutrimental qualities, and, finally, from being combined with the saccharine matter, of which every other species of fecula is totally void.

Thirty-five of the principal physicians and surgeons of Malaga, including the director and professors of the Royal College, and the physician-general of the army, Dr. Andrew Vila, have attested, authentically, its sovereign efficacy in nervous debilities; in the febrile tabes, or consumption, and in the convalescent state; and as a medicine in diarrhœa, dysenteries, and all disorders proceeding from irritation in the stomach and intestinal canal. It has since been seen, with admiration, to cure, in a few days, the most inveterate gonorrhœas; the Fluor Albus, or whites, and excess in the menses; and has been found of admirable use as nourishment for children

during lactation, substituted for the food called pap, which frequently is attended with such bad effects.

The use of this excellent article, is not to be limited solely to the sick; the delicacy of its substance, (attested by the most celebrated cooks and confectioners in Spain,) rendering it of incomparable utility in pastry, fritters, &c., and in custards, blanc-mange, and biscuits, particularly those termed in Spanish, *Borrachuelos*, which, composed of fecula, are absolutely inimitable by the finest flour of wheat.

The most common method of using it as a medicine, or as food, is as follows.

For milk porridge, "*natilla*," take a quarter of a pound of fecula, and dissolve it in a sufficient quantity of cold milk, (that of almonds is preferable, in case of sickness) the lumps must be well mashed; and with the addition of two quarts of milk, put before a slow fire, stirred in one direction till sufficiently boiled, introducing sugar and cinnamon afterwards, as the disease may permit; as a cooling medicine, it is generally used in its crude state, either as a clyster, or as orgeat, with water and sugar, particularly in cases of gonorrhœa, and all kinds of fluxes.

In using the fecula for pastry, fritters, &c. &c. it is necessary to observe, that in consequence of the fineness of its molecula, on coming in contact with liquids, it thickens and increases very considerably; the proportion in which it is to be used, relative to flour, is that of ten and a half ounces, where a pound of the latter would be required. Finally, mixed with one-third part of flour, or in equal quantities, it produces bread, unequalled in point of wholesomeness and delicacy.

Certificates.

I, Don Rafael Briz, doctor in pharmacy, hereby certify, that having been commissioned by his excellency, the governor of this city, to analyze the fecula of the sweet potato, invented and extracted by Don R. Mackinnon, after a most scrupulous examination and repeated trials of this delicate substance, I have found it to be beyond comparison superior to Sago or Tapioca, and worthy of every degree of encomium, for having demonstrated itself, in the most evident manner, from its rare and admirable properties, both physical and chemical, to be the most salutary, select, and pure, of all feculas or farinaceous substances, hitherto discovered, which analytical task I delivered to the said authority, in my exposition of the subject.

Malaga, 4*th November*, 1827. (*Signed*) Don Rafael Briz.

We the undersigned, doctors in medicine and surgery, certify, that having seen the analysis and report of Don Rafael Briz, on the fecula of the sweet potato of Malaga, and carefully observed its admirable effects on a great number of convalescents, to whom we have applied it, sometimes as a cooling medicine, as an alimentary substance, and sometimes as a cathartic, we agree perfectly with his opinion with respect to it, and conceive that, besides its excel-

lent effects, in general, it would be singularly useful in bilious diseases, and cases of dysentery.

Malaga ut Supra.

(*Signed*) Joseph Mary Salamaca, Joseph Prieto Lopez, Rafael Plaza, Joseph Martinez, Joseph Cortez, Antonio Argobejo, Manuel Mary Huzarmas, Gabriel Mendoza, Francis Laleta, Joseph Casablanca, Antonio de Navas, Vincent Orts, Joachin Giraldes, John Buraz, Antonio Ducares and Gomez, Michael Fernandez-Navarro, John Gonzales Calo, Joseph Brull, Joseph Mendoza, Julian Gomez, Christopher Alarcon Parras, Francis de Rula Fernandez, Antonio Rodriguez, John Nepomuceno Fernandez, John Mendoza, Andrew de Castrilla, Francis Falleda, Santiago Lopez, Antonio Ferran, Francis de Estrada, Antonio Cerez, Joseph Felix Guerrero.

I, Don Andrew Vila, Physician-general of the Royal Armies, and of the military hospital of this city, inspector of epidemical complaints in New Castile, Fellow of the Royal College of practical medicine in the court, and one of his majesty's pensioners of merit, certify,

That the healthy state of the lower class, and children who use the boiled sweet potato, as their principal nourishment, the suavity and tastefulness of the fecula, and the inalteration of its properties, by extraction, together with its total separation from the fibrous parts, which alone resist the digestive powers, stimulated me to undertake a course of trials, which I conceived might be useful to the health of the military men under my command, as well as the economy of the royal finances. The dysenteries, degenerated into a putrid and incurable character, which attack the garrisons on the coast of Africa, and whom the benignity of his majesty sends to Spain for their cure, were the first objects of my essays; the use of the fecula speedily calms the symptoms of that terrible disorder, and arrests the progress of the tabes, distinguishing itself, particularly, for its admirable effects, in diarrhœas, which it perfectly cured in a few days. If facts can warrant the fortunate results of sound practice, my observations in the military hospital under my care, convince me even to demonstration, that the fecula of the sweet potato, is of a distinguished use in nervous weakness, in febrile emaciation, and in the convalescent states; and as a medicine in diarrhœa, dysenteries, and every disorder proceeding from irritation in the stomach and intestinal canals. I sign this declaration in Malaga, this 8th day of November, 1827.

(*Signed*) Andrew Vila.

Remarks on Talbot's Propelling Machinery, and on the Chevalier de Baader's claim to improvements on Rail-Roads and Carriages.

TO THE EDITOR OF THE FRANKLIN JOURNAL.

Sir,—In examining the principles of the "propelling engine," invented by Mr. Talbot, which is described in the Franklin Journal

for November, my mind was forcibly struck with the consideration, that a person of intelligence and science, as he is represented to be, should be so egregiously deceived as to the practical operation of his apparatus. His invention seems to be nearly allied to Genet's flying machine, and like him, he evidently belongs to that class of theorizing philosophers, who have clear perceptions enough of the operation of a single philosophical or mechanical principle, when viewed separately, but not of a combination of such principles; and, therefore, are unable to calculate the effects of a complicated machine.

The mode by which Mr. Talbot proposes to propel vessels and carriages, and in the success of which he has furnished evidence that he is sufficiently sanguine, is, as he expresses it, by "*the application of the pressure of the atmosphere as a resisting medium.*" He supposes that when a vacuum is produced in his atmospheric cylinders, as he calls them, by forcing the pistons towards the open end, the pressure of the atmosphere upon the pistons tending to force them back, will drive the boat in that direction. Now if the pistons alone were confined to the boat, and the cylinders were fastened to something of sufficient stability without the boat, and disconnected from it, the pressure of the atmosphere upon the pistons would, unquestionably, tend to propel the boat in the direction of the cylinders. But the whole of Mr. Talbot's apparatus, is placed within, and confined to the boat; so that, so far as the boat is concerned, the power exerted by the atmosphere, as well as by the steam, is entirely ineffective, and the boat, in consequence of the power thus applied, will have no tendency to move one way more than another; for when a vacuum is produced in the atmospheric cylinders, it is clear that the weight of the atmosphere will press the cylinders in one direction, with exactly the same force that it does the pistons in the opposite direction. The same is equally true in regard to the action of the steam upon the steam cylinder and piston: and it would be as feasible to propel a boat merely by working a steam-engine in it horizontally, without the atmospheric cylinders, as with them.

Mr. Talbot has, evidently, deceived himself, by his arithmetical calculations, and by referring the propelling force of his engine, sometimes to the end of the beam E, and sometimes to the fulcrum or middle. He supposes that his two atmospheric cylinders, and the steam cylinder, are pressed towards the stern of the boat, with an aggregate force of 65,974 pounds, this force being applied to the ends of the beam; but in his estimate of the force tending to press the boat in the opposite direction, he supposes it to act upon the fulcrum or middle of the beam, and, therefore, he doubles the power exerted at one end of the beam, and this without taking into the account the force applied to the other end of the beam. Now, it is manifest that, by referring the power to the fulcrum, or middle of the beam, he loses as much in velocity as he gains in intensity, and in this way the opposing forces will be balanced. But, admitting his reasoning, in relation to the first stroke of his engine, to be correct, I would ask him why the beam, at the fulcrum or centre,

will not press with the same force towards the stern of the boat, at the returning stroke of his engine, as it did towards the bow at the first stroke?

In my apprehension, it would be quite as ridiculous to attempt to propel a boat by Mr. Talbot's contrivance, as it would be for the passengers within the boat to attempt to move it in any direction by crowding with their shoulders against one part of it, while their feet rest upon another part; or as it would be for a person to attempt to lift himself in a basket.

If, however, there be a principle in the pressure of the atmosphere which has been discovered by Mr. Talbot, and which will produce the effect supposed by him, he will be able, by its application, not only to propel carriages and vessels horizontally on land or water, but also to force them upwards, and to travel through the air. The discovery of this principle, if it really exist, must be reckoned as one of the most brilliant that has enriched the science of natural philosophy; and, although I have no faith in its existence, I shall be quite delighted if the experiments which Mr. Talbot is about making, shall not disappoint his expectations.

Among the other new inventions mentioned in the last number of the Franklin Journal, upon which the authors appear to have built extravagant expectations, I have also been led to notice that of the Chevalier de Baader, for constructing iron rail-ways and carriages. As the details of his plan are not given, it is impossible to prove that he cannot perform all that he promises. It will, however, require considerable faith to believe, without some other evidence than the Chevalier's assertion, that "he has discovered a new principle, by which the power and motion of stationary steam-engines, established at considerable distances or intervals, and working without interruption, can be imparted to any number of loaded carriages passing upon a rail-way from one engine to the other, *without ropes, or chains, or any other immediate apparatus*, and with any reasonable velocity." This supposed newly discovered principle, whenever it shall be made known, I suspect will be found to bear a strong resemblance to that discovered by Mr. Talbot, and be capable of producing the same effects. But if there be in reality no new principle, by which those wonderful effects are to be produced, I can conjecture no mode, by which the power of a stationary engine can be transferred to a carriage, unless it be by a coiled spring, to be wound up by the working of the engine, and then to be attached to the carriage upon which it shall exert its force thus imparted to it.

It is not my purpose, by these remarks, to deride or repress that spirit of improvement and propensity for inventions, in the mechanic arts, for which the present age is so distinguished; for although many schemes are suggested, and attempted to be put into operation, which have nothing to recommend them but their absurdity, yet the inquiries induced by them may lead, and sometimes do lead, to valuable improvements. B.

Massachusetts, Nov. 10, 1828.

Remarks by the Editor.—Whilst we feel it due to the public to indicate our opinions on the subject of some of the patents granted in the United States, it will be readily perceived that there are considerations which, of necessity, force us to do so with great caution. This, however, is not the case with correspondents; our pages are, and shall ever be, open to the utmost freedom of remark, whenever the advancement of truth appears to be the aim of the writer; and those who think themselves aggrieved, may always be heard through the same medium.

We have read the foregoing article with peculiar satisfaction, as it is, in every particular, in perfect harmony with the views which we have entertained, and expressed. We had repeatedly observed, that if this principle of propelling vessels, &c. were correct, all that would be necessary to carry them up into the air, would be, to turn the atmospheric cylinders, with their mouths downwards, as fluids press equally in all directions. Should the agitation of this subject induce the patentee to pause, to re-examine the ground upon which he stands, and to retrace his steps before he finds himself on the quicksands, the advantage to himself will not be more real, than the gratification which we shall experience, in having aided in producing this result.

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS GRANTED IN OCTOBER, 1828.

With Remarks and Exemplifications by the Editor.

1. For *an Engraving or Etching Machine,* being a new combination of machinery, comprising the principles of the circular and straight line dividing engines, and an engine causing a revolving graver or etching point, to engrave, or trace circular lines, upon either a printing cylinder for printing calicoes and other goods; or upon a mill or cylinder used for transferring patterns upon a printing cylinder for printing calicoes or other goods; or upon a mill, to be transferred to bank note dies; Rufus Tyler, Philadelphia, October 9, 1828.

The patentee states, that he is engaged in making further improvements, so as to render his machine more perfect; for these, when completed, he intends to apply for a patent, and, therefore, requests that a delay of two or three months may take place before publishing an account of his invention, in order that the whole may be presented to the public, in the most perfect form.

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2. A machine for *Washing Clothes and Churning Butter;* John Grout, Caroline, Tompkins county, New York, October 10, 1828.

There is a strong similarity between this machine and several of its predecessors; we, therefore, pass it over without attempting a further description, than merely to say that there is a box, or trough,

fixed upon rockers, with a beater and strips within the box, and that a rocking motion is to be given to the whole, when the machine is used.

3. An improvement in the *Machine for Picking Cotton;* James Pinell, and Aber Maxson, Barboursville, Cabell county, Virginia, October 10.

The object proposed is, to turn the ordinary machine for picking cotton, by means of the foot applied on a treadle, exactly in the manner of the common turning lathe, and thus to substitute the power of men, for that of horses.

The brushes used to remove the cotton from the saws, are not attached immediately to the shaft, there being "two or more steel springs, fastened at one end to the stock of the brush, and at the other to the revolving shaft; the effect of which is, to admit of a vibration, which frees the brushes from the cotton, without the trouble of cleaning them."

What is claimed, "is the application of the crank, the treadle, and the fly wheel, so as to turn the same by means of the foot; and the use of the spring at the backs of the brushes."

4. An improvement in the *art of Melting and Fusing Glass;* and the materials for making and forming glass; Thomas W. Dyott, M. D. Philadelphia, October 10.

(See specification.)

5. An improvement upon the ordinary *Machine for Carding Wool;* Don Marcus Bacon, October 10.

(See specification.)

6. For the use of *Pine Resin* as an article of fuel *for the purpose of heating ovens* for the baking of bread, bread stuffs, meats, and such other articles of food as may be best cooked by baking; also for the purpose of heating hatters' kettles, used in the manufacturing and colouring hats; Richard L. Wood, Philadelphia, October 10.

The following is the specification.

"The manner of using the resin, is to break it in small pieces, and ignite a sufficient quantity at the entrance of the flues, so constructed as to pass around, and over the top of the ovens used for baking, and under and around the kettles used by hatters; adding a sufficient quantity, from time to time, to produce the required heat."

Remarks.—The foregoing, it is presumed, was suggested by the employment of rosin in Dr. Dyott's glass house, which fact was known in Philadelphia. Although the patents were issued on the same day, the application for that for fusing glass was antecedent to that of Mr. Wood. The purposes for which rosin is proposed to be used by each, differ specifically, and were not, therefore, considered as interfering applications. If the respective patentees can

sustain their claim to the use of rosin, it must, of course, be limited to the precise uses named by them.

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7. A machine for *Thrashing Grain*, denominated the "American Thrasher;" John W. Post, of Philadelphia, and John Ryan, of New Baltimore, Virginia, October 10.

In this machine, there are to be two feeding rollers, into which spikes, or teeth, formed of wire, are to be driven: the gudgeons of the upper roller work in a groove, to admit of its rising and falling with the varying thickness of the straw in feeding. The beating cylinder has two, or more strips of wood, running its whole length, and armed with strips of iron on the edges which beat out the grain; there are teeth, in one or more rows, set along these strips, and behind the beating edges, for the purpose of combing in, between the straws, and of thus obviating the difficulties which arise from the beaters consisting of a straight edge only. The patentees propose sometimes to omit the feeding rollers, and to substitute an arrangement of slightly projecting spikes in a straight feeding-board. Some other modifications are mentioned, as may be seen by the claim, which is, "the addition of spikes upon the beating strip attached to the cylinder, with the spikes standing back, and projecting beyond the strips; the application of two of the above beating cylinders, and the omission of the curb; the omission of the feeding rollers, and the curb, by the application of one of the beating cylinders, and an arrangement of spikes immediately under the cylinder, in a straight feeding-board."

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8. A machine for *Mortising and Tenoning Timber;* William Jackson, and J. J. Speed, jr. Speedsville, Tompkins county, New York, October 10.

The general construction of this machine is that of a common saw mill in miniature; there being a frame with a carriage on it, upon which the piece to be mortised, or tenoned, is to be secured. There is an ingenious, but simple contrivance, for shifting the pieces laterally, so as to adjust them, by bringing the gauge marks to the saw, or chisel. A saw is strained in the frame, when tenons are to be cut; and this, for mortising, is to be replaced by a chisel. There is a slip rail attached to the saw frame, for straining the saw, or for adjusting the chisel so as to enter the proper depth. A feeding arm causes the carriage to advance, by working on a straight rack. The ordinary mode of working the frame, is by a lever, in the manner of the common pump handle. "The chisels to be used, may be the common mortising chisel, the grooved chisel, or the common mortising chisel, with a steel spring on the back, having a beard on the lower end of the spring next to the chisel, to lift out the core or chips." "What we claim as our invention, is the particular construction, as described by us, of the set or gauge for confining and regulating the timber. Also the slip rail in the gate, regulating the depth of the chisel, and straining the saw, together with the

spring chisel before mentioned." "We also claim as a new application of parts heretofore known and used, the saw gate, balance, and lever, as before described."

9. An improvement in the *Pump for drawing Beer and Cider, Soda Water, &c.;* Levi Pitkin, Rochester, Monroe county, New York, October 11.

The object proposed, is to get rid of the poisonous matter contained in the metallic tubes and chambers of the pumps generally used. The following is the whole of the specification.

"The object of this improvement, is to do away the corroding, or poisonous effects of using metallic substances, or materials, in the construction of such pumps. The construction of the improved pump, is the same as those now in use, the only thing claimed as new, being the materials of which this improved beer pump will be constructed; which are either lignum vitæ, ebony, or other suitable wood; marble, free, or other stone; stone, or earthenware."

10. A triangular measure *Ruler for delineating Garments;* Allen Ward, Philadelphia, October 11.

(See specification.)

11. Improvement in the machine for *Sawing Clapboards* with a circular saw, for which a patent was obtained by Robert Eastman and Josiah Jaquith, March 16th, 1820; Jonathan Kidder, Gorham, Cumberland county, Maine, October 11.

In order to describe these improvements, we must present engravings, not only of them, but of the original machine. This we shall not now do, but merely give the claim of the present patentee, reserving a particular description for a future occasion. "I claim as improvements upon Eastman & Jaquith's original machine, the two bevel wheels, the rag-wheel, the lever, the hands, the moveable pin aforesaid, and nothing more."

12. A mode of *Covering Buildings;* Hazard Knowles, Colchester, New London county, Connecticut, October 11.

The process is, to nail cloth (hemp cloth being preferred) upon a smoothly boarded roof. To cover this cloth with wheat or rye paste to fill the pores, and make it smooth, and then to cover the whole with ordinary oil paint.

For information on this subject, our readers are referred to p. 172, vol. 1, and p. 345, vol. 4, of this Journal.

13. A mode of *Constructing Doors,* to secure buildings against cold and storms; Daniel Williams, jr. New London county, Connecticut, October 11.

A groove is made along the under edge of the door, and within this a metal plate, or strip, reaching the whole width of the door, is hung upon pivots at the ends, so as to close upon the sill, when the

door is shut. The particular arrangement cannot well be explained in words, and the drawing furnished is not very descriptive.

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14. An improved machine for *Cutting Rags* for the manufacture of paper; Moses Y. Beach, Springfield, Mass. Oct. 11.

This machine bears a strong resemblance to some of those used for cutting straw. There is a heavy fly-wheel turning on a stout iron shaft, the gudgeons of which rest on a strong frame; two or more arms project at right angles from the shaft of the wheel, and carry knives, or cutters; on the edge of the frame, a cutter is firmly fixed, so that the others, in their revolution, pass it, and cut, like the blades of shears. There is a feeding cloth passing round rollers, like that in the carding machine: upon this cloth the rags are placed, and carried by proper gearing, between the cutters. By altering the gearing, the rags may be cut more or less fine, as they may be wanted.

"The inventor claims as new, the use and application of this machine for cutting rags for the manufacture of paper, by means of improvements adapting it to that use; consisting in extending the horizontal shaft through the axis, so that each end of it rests in the strong frame, thereby giving stability and uniformity to the motion of the knives; also in the increased power derived from increasing the weight and dimensions of the wheel and arms, beyond what has heretofore been used or known for any similar operations. Also in the use of the arms, one or more proceeding from the horizontal shaft, and attached to the balance wheel, or placed at a distance from it, as may be preferred; also in the use of the regulating screws which hold said knives in their places, and graduate them as required; also in all the other particulars above specified, so far as they differ from all other machines heretofore known or used."

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15. Improvement in *Window Blinds;* John Parkerson, Boston, Massachusetts, October 11.

The plan proposed, is to have two metal pins projecting from each end of the slats of which the blind is composed; these pins are to pass into holes made in moveable strips, confined within the edges of the frame of the blind. These strips are confined in their places, and made to traverse up and down, by means of flat disks or wheels, of metal, which turn on centre pins, between the sliding strips and frame, having each two pins in their peripheries, which pass into holes in the sliding strips, in the manner of the pins on the ends of the slats.

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16. *Fastenings for Bedsteads* and other framings, by a mortise and tenon, called the "Mortise and Wedge dove-tail tenon Fastening;" William Swift and William Ottivelle, New Bedford, Massachusetts, October 11.

The exact construction of these cannot be shown without drawings: the general principle of their action, is similar to that of some

fastenings previously known. Plates are let in and screwed on to the posts, and are flush with their surfaces: in these plates are mortise holes and slots, to admit iron pins, which are let into the ends of the rails; there being two in each end, near their upper and lower sides. The back parts of the plates are dove-tailed, or wedge shaped, and upon these wedge shaped parts, notches upon the ends of the pins, bear, and are tightened by being forced down. They are well represented in the drawings which accompany the specification; but as they will, probably, be found at an early day in most of our hardware stores, an engraving of them is unnecessary.

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17. For *Preparing the Back-lint, or Fibres of Hemp;* Abraham K. Smedes, October 11.

(See specification.)

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18. A *Rotary Steam Engine,* for propelling vessels, or machinery, or for any purpose to which steam power is applied; Stillman Blake, Providence, Rhode Island, October 11.

(See specification.)

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19. *Spinning and Roping Cotton and Wool,* by a machine called the "Complete Spinner;" John W. Wheeler, Galway, Saratoga county, New York, October 11.

This is one of the machines commonly called "Domestic Spinners;" and is intended to run from eight to about twenty-four spindles. These are all, of course, modifications of the larger machines used in cotton and wool factories. In this instrument, the rims of the band wheels are directed to be made of strips of raw hide, formed, whilst wet, upon wooden moulds, and allowed there to dry and become hard. The collars, or poppet heads, as they are called, of the spindles, are directed to be made in a peculiar way, of leather, and of horn. A particular mode of tightening the bands is designated, and there are some other variations in the arrangement of the parts. The claims of the patentee, are as follow:

"1st. The raw-hide rims of the wheels.

2nd. The manner of placing and applying the friction pulleys, so as to produce equality of bands, and diminish friction.

3d. The particular mode of communicating motion to the spindles, by arranging, gearing, and banding the wheels, friction pulleys, and spindles.

4th. The peculiar mode of hanging the spindles."

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20. Improvement in the *Revolving Rail, and Round Tenon Bedstead;* Garret Post, Auburn, Cayuga county, N. Y. Oct. 11.

Round side and end rails, with ratchet wheels, and clicks, or falls, for tightening sacking bottoms, have been patented both in this country and in England. The present patent varies the use of round rails and tenons, by letting plates of metal into the posts, so as to be flush; these plates to have holes in their centres, to receive the tenons, and a circle of smaller holes at a sufficient distance from

them, to receive the points of bolts, fixed longitudinally in the rails, to retain them in their places, when the sacking is strained. It is also proposed, sometimes to use the ratchet wheel, cast so as to form a cap to the rail, having the tenon cast on to it, and affixed to the rail by screws. The rails to be tightened by a lever fitting into a hole in the rail, or by taking a hitch with a cord upon one of the pins to which the sacking bottom is fastened. The sacking is either to have holes worked in it, as usual, to hitch upon pins on the rails, or a cord is sewed within the edge of the canvass, and loops left to pass over the pins. To prevent the rails from springing, braces are formed by pieces of plank, placed edgewise, and passing from side to side, their ends being hollowed so as to fit the rails, which, consequently, retain these stretchers in their places.

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21. An improvement in the machine for *Carding, Winding, and Making of Hats,* or felts; Isaac Sanford, Blockley, Philadelphia county, Pennsylvania, Oct. 11.

There is a curious history attached to this machine, the particulars of which we cannot give, but will merely state the fact, that it has lain dormant for about twenty-nine years, the money having been paid into the treasury, on the 22nd of February, 1799; and a model having been deposited in the office on the 21st of December, in the same year. Since that period, the inventor has been engaged in other pursuits, but has, within a few years, again turned his attention to the subject of this machine, and has taken out his patent.

We cannot furnish, without engravings, a description which would give any adequate idea of the construction of this ingenious instrument, and we shall, therefore, not attempt it. A number of machines, for the same purpose, and having many parts in common, have been patented, and suits respecting their validity are now pending. The present claim appears as a veteran in the field, so far as age is concerned, but in the contest, is a new recruit; should it prove a soldier of fortune, its merits shall, hereafter, be made known.

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22. A *Machine for Cutting Files,* called "Hatch's Improved File Cutter;" John Hatch, Roxbury, Norfolk county, Mass. October 11.

This machine is intended for cutting files entirely by pressure, without a blow from a hammer. The whole instrument with its adjustments are necessarily complex; and as the object of cutting files by pressure is novel, the patentee has not thought it necessary to claim any particular part, but has given a description of the whole.

The file to be cut, is sustained upon a firm bed or anvil, the chisel, placed at the proper slope, is worked by a toggle joint, and the motion is regulated by a heavy fly-wheel. The file to be cut is carried forward by a screw, moved by a ratchet wheel, the feed of which may be regulated. As files are taper, the bed upon which the file is cut, is raised or lowered by a sliding piece, which passes under it, and which advances with the file. The form of this piece

must correspond with that of the file, being in shape exactly its reverse; that is, as files are thickest in the middle, this must be thinnest there, and diminish, or increase, exactly in this reversed proportion.

These are the essential features of the machine, but with respect to its operation, we have our doubts. File cutting machines have been repeatedly made, but we do not know that any of them have been found to answer so well as the hand of a clever workman; and we know, that most, if not all of them have been abandoned. Two difficulties appear to us to present themselves in the action of a machine to operate by pressure; the first is, the necessity, and extreme difficulty, of making the blanks to be cut, perfectly true, and all alike in their relative thicknesses; and without this, the guide cannot raise the bed so as to cause the cutter to bear every where with equal force. The plan proposed will not obviate this, nor do we know of any by which it can be overcome. The second difficulty which we apprehend, is in the effect produced by pressure, when compared with percussion. We must doubt whether the same kind of edge will result from successive cuts by pressure, and by blows; this is a point which experience alone can decide, and we should like to know the result.

We could urge other objections, but forbear, and hope that the experience of the inventor may convict us of error in those already made.

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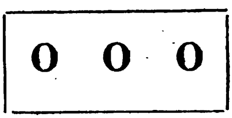
23. An improved mode of constructing *Stereotype Blocks;* Samuel G. Goodrich, Boston, Massachusetts, October 11.

This is a very simple and neat contrivance, for fixing stereotype plates upon a wooden block. A strip of brass, is firmly screwed on one edge of the block, and projects, in two places, above its side, so as to form a lip, to receive one edge of the stereotype plate. A notch is cut on the opposite side of the block, to receive, and allow play to a moveable lip of brass, which is to confine the other edge of the plate. This moveable lip, is perforated with three holes in a row, as in the margin. The two outer holes have wires soldered into them, which project out about two inches, and slip, neatly, into corresponding holes in the edge of the block. From this same edge, projects a screw, which passes through the middle hole; upon this screw a nut is fitted, and is turned, first by the fingers, and then by a small wrench, so as to cause the projecting lip to embrace the plate firmly. A brass plate, the whole length of the block, is screwed upon its edge, so as to cover the notch of the moveable lip. This plate is hollowed at its upper edge, opposite the nut, to allow it to be turned with facility.



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24. Making *Cast Iron Hubs* (or naves) for wheel carriages; William Dickinson, Batavia, Genesee county, New York, October 11.

This hub is cast in five pieces, so formed as to fit together, and present a perfect nave, to receive the spokes and axle.

The patentee describes the whole, but does not specify any particular point which he claims.

Cast iron hubs have been made repeatedly, but it is said that they are too hard for the wood. In mill wheels of cast iron, which move steadily, spokes of wood will continue to fit well, but in carriages, where there are perpetual jolts, the iron has been found to bruise the wood, and cause it soon to work loose. Where water insinuates itself into the mortise, so as to rust the iron, this rust acts upon, and injures the wooden tenon. We have not had sufficient experience of the fact ourselves, but these are the objections urged.

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25. Improved construction of *Pipe Boilers for Steam Engines;* Alden Potter, New York, October 11.

The specification is in the following words:

"The pipes are made with an elbow, the two arms forming a right angle. The small end of one pipe, is received into the large end of another, and the two are held firmly together, by a bolt passing lengthwise through one arm of each pipe, the bolt having a nut and screw at one end, and a head on the other end."

"Each pipe is raised at one end, so as to elevate, successively, every layer, or coil of pipe; thus forming a continued line of pipe, of any required length, similar to the worm of a still, but describing a square, or parallelogram." ALDEN POTTER.

The remainder of the patents for October, will appear in the next number.

SPECIFICATIONS OF AMERICAN PATENTS.

Specification of an apparatus for Saving Heat, in the process of Combustion. Patented by STEEN ANDERSON BILLE, *of New York, Nov.* 8, 1828.

THE atmospheric air, necessary for combustion, is generally supplied by means of the draft, resulting from the rarefaction of the air in the fire-place, and, therefore, at the expense of the heat, carried off by the smoke, or foul air, escaping through the chimney. From the specific heat of atmospheric air and steam, at equal temperatures, estimated by volume, being nearly as 50 to 31, it follows that the escape of 50 cubic feet of atmospheric air, at a temperature of 212°, will be nearly equal to the escape of 31 cubic feet of steam of the same temperature, which proportion is still more increased in favour of smoke, on account of the steam and carbonic acid gas formed by the combustion; when in addition to this it is considered, that the atmospheric air, by an elevation of temperature from 32° to 212°, only suffers an expansion of about 37½ per cent. giving a pressure upon the square inch (in proportion to the difference in weight

of the column of air so heated and kept together in the chimney, and the atmospheric air, generally,) of less than half an ounce, upon which pressure the natural draft, as it is called, exclusively depends, it becomes obvious at what immense expense this natural draft is procured, and how very small the mechanical power is, upon which the whole operation depends. The undersigned, therefore, proposes to substitute a direct application of mechanical power, for producing the draft required, endeavouring, at the same time, to a certain extent, to prevent the heat of the smoke from escaping. The draft he proposes to effect, by the application of one or more suction bellows, which, at the same time, will enable the operator to give to the current of air required, any direction he may desire. In thus sucking the smoke from the end of a horizontal chimney, which may, as well as the bellows, for convenience sake, be placed under ground, the smoke will escape through the bellows with as much, and even more regularity, than it does in the ordinary way through an upright chimney. If to this arrangement be added a system of tubes, enclosed in the said horizontal chimney, and so disposed as to communicate with the atmospheric air at the same end of the chimney where the smoke escapes, and with the ash-pit at the other end, while the ash-pit has no other inlet, it is evident that the atmospheric air will enter, and the smoke will escape, in opposite directions, which, naturally, will cause an exchange of temperature from the extent of surface exposed to the operation of mutual contact; where the atmospheric air enters in a cold state, the smoke will escape nearly so, and where the smoke rushes from the fire-place in a hot state, the air will enter the ash-pit heated nearly to the same degree. Thus the greatest portion of the heat of the smoke, otherwise spent, may be saved; the operator will be unrestrained in the construction of his fire-place; he will have it in his power to effect a perfect combustion, and to distribute the fire and heat as he may deem expedient. The anthracite coals, which cannot stand the blast of cold air, will be very eligible under a draft of heated air; the upright chimnies, so disfiguring to steam boats in particular, may be dispensed with, and the foul air let out at any convenient place, at a very reduced temperature. In high pressure steam engines, a similar advantage may be taken from the heat of the steam, altogether lost in the ordinary way of letting it out. The power required for working the bellows, will, from what has been stated above, be very inconsiderable. It must be borne in mind, that the bellows are not intended to compress the air, as in a furnace or forge, to produce intensity of heat, but their object, in the present instance, is barely to imitate the common draft; a mere fanning, or moving of one column of air in its own medium, succeeded by another column, without any effort or attempt whatever at compression; hence, no particular strength is required in the bellows, nor any tightness, that might cause friction; a revolving fan in a circular box, like a shallow vat, but of large diameter, will, in the opinion of the undersigned, be the best adapted form for the purpose, sucking the smoke from an opening behind the fan, on the revolving and hollow draft,

and pushing the smoke before it through a similar opening in the shaft, serving as the inlet, and the top part of it as the outlet, of the smoke, separated by a partition in the shaft, while two slides in the box, placed opposite to one another in the same vertical plane, alternately divide the box, for suction and discharge of the smoke in question. These slides are moved by cranks, in such a way that both close in to the revolving shaft when the fan is in a rectangular position to them; after which, the one in the way of the fan recedes gradually, allowing the fan to pass, and this done, it resumes again its former position, by the time the fan arrives at the opposite rectangular position, and so on alternately. The undersigned claims thus, as his invention, by the application of smoke sucking bellows, in effecting the draft necessary for combustion, so to direct the current of air as to cause a great portion of the heat of the smoke to be absorbed by the air in its passage to the fire-place, from the extent of surface exposed to the operation of mutual contact, while the air and smoke are made to move in opposite directions.

STEEN A. BILLE.

Specification of an improvement in the art of preparing the Back-lint, or Fibres of Hemp, for manufacturing purposes. Patented by ABRAHAM K. SMEDES, *of Lexington, Kentucky, October* 11, 1828.

AFTER separating the back-lint, or fibres, from the wood, or bullen, of the stalk, in an unrotted state, which may be done by hand, but more advantageously by machinery now used for that purpose, the hemp lint, or fibres, or back, to preserve it from tangling, should be loosely twisted, or tied into bundles of a size convenient for handling. It should then be immersed in water, where it should remain until the epidermis, or thin outer membrane shall be destroyed, and until the vesicular or cellular substance which unites the longitudinal fibres, or a part of it, is also destroyed. The back-lint, or fibres, may be immersed in water retained in vats, ponds, cisterns, or other convenient receptacles, or in running streams.

The time required for the preparation or completion of the process, depends, somewhat, on the temperature of the water; a considerable advantage results from heating the water, thereby facilitating the operation. When the water is confined in cisterns, or otherwise, from two to six days will be sufficient for the purpose of destroying the epidermis and part of the cellular substance, which may be ascertained by its becoming loose and slippery to the touch.

The hemp should then be withdrawn, and dried in the common air, or by fire. Let it then be run through the break again, which softens it, and disengages whatever particles of wood or bullen may remain attached to it, and also the cellular substance and epidermis, that may have dried upon it. It may then be applied to the scutcher,

or hacked, which frees it from all the tow and dust, and leaves it in a proper state for market, or use.

The great advantage resulting from the foregoing process, arises out of the ease and facility with which large portions of hemp can be prepared in a small space, and in a manner equal, if not superior, to that which is water rotted on the wood or bullen, and in a great measure, removing the difficulties arising from the unhealthy and offensive effluvia growing out of the decomposition of vegetable matter.

ABRAHAM K. SMEDES.

Specification of an improvement in the mode of operating the rotary Steam Engine for Propelling Vessels, or Machinery, or for any purpose to which steam power is applied, by the application of steam to mercury. Patented by STILLMAN BLAKE, *Providence, Rhode Island, October* 11, 1828.

A BUCKET wheel is constructed, similar to the common bucket water wheel, and either solid, or close, so as to exclude any surrounding fluid from the inside. This wheel is made of iron, or any other strong material.

The wheel is enclosed within a cylindrical box or shell, which is air-tight, and sufficiently large to leave a small space between it and the surface of the wheel, for purposes hereinafter mentioned. This box is also to be made of iron, or some other strong material, in two or more parts, and secured together by bolts.

Into this box, a steam pipe is introduced, and passes down between the wheel and shell, terminating nearly under the centre of the wheel.

From the upper part of the box, an abduction pipe leads to a condenser, where the steam, after having performed its office as below described, is condensed, and leaves nearly a vacuum in the upper part of the cavity between the wheel and box, allowing the wheel to act more advantageously than it otherwise would.

The machine thus constructed, the space or cavity between the wheel and box, is filled with mercury nearly as high as the centre of the wheel. The steam is injected into the mercury, through the steam pipe, and immediately rises into the buckets, nearly under the centre of the wheel, and displaces a portion of the mercury.

The buckets, on one side of the centre of gravity of the wheel, being successively filled, or partly filled with steam, its buoyancy gives motion to the wheel, and the power afforded is in proportion as the weight of the mercury displaced, exceeds that of the steam employed.

Motion is communicated to machinery, or to whatever steam power is applied, by passing the shaft of the wheel through an accurately fitted bearing, in the end of the box or shell.

It is intended that the buckets be filled about one-third part full of

steam at first, and as they ascend, the pressure upon the steam is gradually diminished; it, consequently, expands, and, at the surface, occupies the whole space within the buckets, to the entire exclusion of the mercury, and affording a proportionable increase of power.
Stillman Blake.

Remarks by the Editor.—We have, repeatedly, made known our views respecting the inefficiency of all the rotary steam engines hitherto made, and, we apprehend, that the present attempt will not cause us to relax in its favour. A vast power will be required, to force the iron buckets to wade through so dense a fluid as mercury: in doing this, we suspect more power will be lost than that from the friction of the piston, and all the other parts of the ordinary engine. Highly elastic steam must be used; for should the wheel be six feet in diameter, more than the pressure of an atmosphere will be required to cause the steam to issue from the induction pipe.

A condenser is proposed to be used: there must, of course, be an air-pump, or the condenser will not operate; as no particular plan is given, this, we suppose, is to be constructed in the ordinary way.

Specification of an improvement in the art of Melting and Fusing Glass, and the materials for making and forming glass. Patented by Thomas W. Dyott, M. D. *Philadelphia, October* 10, 1828.

The discovery and improvement consists in using the *resin of pine*, commonly called rosin, as fuel, either alone, or together with other fuel, for the melting and fusing glass, and the materials for making and forming glass.

The advantages of the improvement consists—in the economy of time, in bringing on a melt, two or three hours sooner than can be obtained with wood; in the greater certainty of the quality of the glass; the *bache*, or composing materials, being frequently subjected to a strong heat by a wood fire, yet, in consequence of the quality of the wood, not strong enough to fuse; no heat applied afterwards, will make the glass of good quality, although it may be melted, the salt and pearl ashes being decomposed before the fusing point of heat is brought on. By the use of rosin, this difficulty is obviated, the quality of the fuel being always the same, and unaffected by a damp atmosphere.—In the greater economy of the materials; the pots containing them being frequently broken, and the metal running into the furnace, mixes with the coals and ashes, and becomes black, of less strength, and fifty per centum less in value. In the use of rosin, the glass subjected to such accident, will run out nearly clear, and be as strong as at first.—In a great economy in the cost of fuel, saved principally in the difference of labour in sawing, splitting, oven drying, and preparing the wood; and in the difference of freight and hauling for the rosin; and in the greater

security of the works; the quantities of wood necessarily collected being exposed to accidents by fire, to which the rosin will not be liable. Thomas W. Dyott.

Specification of an improvement upon the ordinary Machine for Carding Wool. Patented by Don Marcus Bacon, *Huntington, Pennsylvania, Oct.* 10, 1828.

My improvement upon the machine for carding wool, consists in raising the main cylinder of the carding machine, about fourteen inches above the frame, so that a larger portion of its surface may be made to act upon the small cylinders. In the ordinary machine, there are three or four workers, and two strippers: by my improvement, I usually employ seven workers, and three strippers. The seven workers are operated upon by two separate bands or cords, from the same whorl, on the doffer shaft. By this arrangement, three or four of them may, at any time, be stopped, when it is intended to run the wool twice through; or by running the whole number, the work may be completed at one operation. What I claim as my invention is the employment of the additional workers and strippers. Don M. Bacon.

Specification of a Triangular Measure-case Ruler, for delineating garments with, or by. Patented by Allen Ward, *Philadelphia, October* 11, 1828.

To make a triangular measure-case ruler, for delineating garments, I first procure three strips of tin or other metal plates, with which I form a triangular tube, having the edges of the metal strips turned outside, forming a trough or groove of each strip. I next proceed to solder the three troughs, or grooves, together, which, of course, forms a triangular tube, with the troughs or grooves outwards. I next prepare each side of the triangle for receiving the scales which are to be used therein, by regulating the depth of the groove or trough to the thickness of the scales, and by marking on each side of the triangular tube, some peculiar mark, such as is used in music to denote tunes, flats, sharps, &c.—any character will do to know the scales apart by. I have used a sharp to designate the scale of lengths, or heights, of each customer, and have marked the character on the side where the length scale belongs; and on the second side, I have marked the character of a *la*, or, in other words, a hollow square, which denotes the waist scale; lastly, I have marked the third side of the triangular tube with the character of a natural, which denotes the breast scale; and into these three grooves I slide each respective scale, according to the height and thickness of each customer. I also make some triangular measure-case rulers for delineating garments by, of wood, which answer the same purpose,

but are not so durable. To make a wooden triangular measure-case ruler for delineating garments with, I take a piece of wood, about two feet long and two inches square, of which I form a triangular ruler; in each side of which I plough a dove-tail groove for the scales to slide in. I then put a band of wood or metal round each end, for the twofold or double purpose of holding the marks or characters of each scale, and for a supporter of a wedge with which the scales must be secured, to keep them from sliding back and forth.

ALLEN WARD.

FRANKLIN INSTITUTE.

Report to the Board of Managers on the Fifth Annual Exhibition.

To the Board of Managers of the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, the Committee on Premiums and Exhibitions beg leave respectfully to report:—

THE fifth annual exhibition of the Franklin Institute, was held in pursuance of notice, at the Masonic Hall, on the 8th, 9th, 10th, and 11th days of October, at which time the committee were much gratified to find a rich and varied collection of the products of American skill and ingenuity. The articles presented were not so numerous as at the exhibition in 1826, but displayed, generally, an improvement in style and workmanship, highly creditable to our workmen, and afforded a reasonable hope, that in a few years the advanced state of knowledge, will place the mechanical productions of America, not only beyond the competition of foreigners in our own market, but enable us to enter into a fair competition with them in other countries. Of the 45 premiums offered by the Institute, 20 were claimed by one or more competitors, of which three remain under advisement, and 9 were awarded by the committee to successful competitors. Of the remainder, several were withheld, because the condition of the proposal was not adhered to.

Premium No. 4—For the best specimen of Annealed Cast Iron, is awarded to Seth Boyden, of Newark, New Jersey, for specimen No. 163, being an assortment of buckles, bits, and other castings, remarkable for their smoothness and malleability.

This is the first attempt in this country to anneal cast iron for general purposes, that has come under the knowledge of the committee, and the success attending it, fully entitles the maker to the silver medal.

Premium No. 12—To the inventor of the best constructed Furnace and Boiler, superior to any now in use, for consuming anthracite in generating steam. This premium has been claimed, but the award is still under advisement.

Premium No. 13—To the maker of the best Fire Bricks. The

award of this premium is left open, in accordance with the terms of the proposal, until the samples shall be sufficiently tested.

Premium No. 14—To the maker of the best Currying Knives, equal to the best now in use. This premium was claimed by two competitors, each furnished with very satisfactory certificates, as to the quality of their knives. John Shugart & Co. of Chambersburg, and Jacob Barrick, of the same place. As curriers' knives are implements which require a peculiar temper, very difficult to attain, and which can only be judged of by experiment, your committee accept the suggestion of the judges, and suspend the award of the premium until the knives can be fairly tested and compared, by a special committee, appointed for that purpose. As soon as their report is received, it shall be made known.

Premium No. 16—For the best specimen of Japanned Waiters or Trays, made and japanned in Pennsylvania, is awarded to John V. Blackmore, of Philadelphia, for specimens Nos. 71 and 72, being two dozen of waiters made by him, of a quality not inferior to the imported. The committee regret that the specimens presented by William Nash, of Philadelphia, were deposited too late to be referred to the judges; they could not, therefore, enter into competition with the above.

Premium No. 17—To the maker of the best Surveyor's Instrument, is awarded to Stancliff & Draper, of Philadelphia, for specimen No. 316, being an engineer's level, provided with Mr. William Strickland's divided horizontal circle. This instrument is remarkable for the beauty of its workmanship, and the accuracy with which it is divided, and fully entitles its ingenious makers to the silver medal.

Premium No. 20—For the best Porcelain made in the United States, gilt, painted, and plain—"one hundred pieces must be exhibited;" is awarded to William E. Tucker, of Philadelphia, for specimen No. 253, being an assortment of porcelain, of first and second choice.

In awarding this premium, the committee feel pleasure in noticing the great improvement which has taken place in the manufacture of this beautiful and interesting product. The judges report that they have compared the sample, called technically "first choice," with the best specimens of French China, and found it superior in whiteness, and the gilding well done. The same remark applies to the painting, with some exceptions; this part of the process being still susceptible of some improvement. The committee recommend this "first choice" to the public as of a quality not easily to be surpassed; and award to the maker the silver medal.

Premium No. 27—For the best specimen of Stair Carpeting, in imitation of Venetian, is awarded to James B. M'Fee, of Philadelphia, for specimens No. 96 and 97, two pieces stair and entry carpet, which reflect great credit on the maker.

Premium No. 29—To the maker of the best specimen of Calicoes or Prints, for ladies' dresses, made in the United States, is awarded to the Merrimac Manufacturing Company, for specimen No. 149. Prints were deposited, also, by the Taunton Manufac-

turing Company, and from the Warren Factory, near Baltimore; the latter low priced goods. It is but justice to all parties, to state, that the judges remarked the great improvement that had taken place in printed goods since the last exhibition. They had great difficulty in deciding whether the Merrimac or Taunton goods, should have the preference, both being well executed, and of brilliant colours. After some hesitation, they awarded to the Merrimac Company the silver medal.

Premium No. 35—To the maker of the best Sofa, is awarded to Anthony G. Quervelle, for specimen No. 55, being the most complete and best finished of any exhibited.

Premium No. 37—To the maker of the best Chairs, one dozen to be exhibited; is awarded to William Hancock, of Boston, for specimen No. 35, being one dozen mahogany chairs, well framed and finished; remarkable for the excellence of the carving, which was clean, bold, and in good taste.

Premium No. 45—To the pupil of the High School who shall execute and exhibit the best specimen of perspective drawing from machinery; is awarded to Robert P. Warner, for specimen 282; being a drawing of an air-pump, the best exhibited.

In addition to the premiums awarded to those competitors who claimed, under the proposal issued by the Institute, your committee, in pursuance of authority to grant premiums and special notices to such specimens exhibited, as may be worthy of most compliment, either for excellence of workmanship, or ingenuity, or other peculiar circumstances, have awarded:

To James Devoe, of Kensington, a silver medal for two models of steam engines, made by him. The maker of these models is a lad, apprentice to John Walcham of Globe Mill Factory, and they were made at his leisure hours. The committee have not awarded this premium with any view to the intrinsic merit of the work; but they deem it within the province of the Franklin Institute, to encourage and reward examples of industry, perseverance, or ingenuity, among our rising mechanics. These models evinced a talent uncommon in so young a lad.

To S. P. Wetherill & Co. Philadelphia, for two pigs of lead; being a part of 1000 pigs, the product of their Perkiomen mines, smelted by them. The quality of this lead has been fairly tested by being manufactured into white lead. After a series of years of expensive and fruitless attempts to smelt this ore, these gentlemen have at last succeeded in rendering available, another product from the inexhaustible mineral resources of Pennsylvania. A silver medal is awarded.

The committee also award the silver medal to Wm. & T. H. Day, of Philadelphia, for specimens 14, being an assortment of door locks. These locks, of which the makers are, also, the inventors, were good and well finished, displaying much ingenuity in their construction; all of them were safety locks, presenting almost insurmountable obstacles to the pick-locks: a particular description will be given in the detailed report of the exhibition.

Ten pieces of Flannel were presented from the Yantic Factory, Connecticut. The judges reported them to be of a very superior quality, and the committee adopt their suggestion, and award to the maker, a silver medal.

To Lloyd Mifflin, for No. 201, hearth rugs wove by him. These rugs were the first produce of machinery, invented by him, entirely upon new principles. The rugs were well made and substantial, and bid fair to rival the best imported article. The silver medal is awarded.

To Messrs. Terhooven, for a sample of pins, made and presented by them; the pins were, in most part, of excellent quality, and reflect much credit on the makers. For the introduction of this useful and important branch of manufacture, the committee award the silver medal.

Marble mantels from the manufactories of Tennant & Highlands, P. Fritz, J. Struthers, and S. & J. Jardin, fully sustaining the high reputation of Philadelphia workmanship, were presented. Those from Tennant & Highlands, were much admired for the taste of the design, and pleasing appearance. Those of American and foreign, and American marble, made by P. Fritz, were adjudged to be the best in point of workmanship. The next best, a pair of American and foreign, by J. Struthers. Honorary mention was awarded.

The Franklin Institute has never been favoured with a more splendid display of pianos, than at this exhibition. Thirteen were presented from E. Pommer, C. F. L. Albright, J. J. Meckley, Loud & Brothers, S. Sweitzer, and —— Myers, of Philadelphia, Curtis & Gilbert, and A. Babcock, of Boston. As no premium was offered for pianos, presented at this exhibition, the committee forbear, at present, making any distinction; but in their detailed report, to be presented in a few days, a description of each, with their merits, may be expected.

To Stanley & Co. of Baltimore, an honorary mention is awarded, for 3 pieces mixed sattinets; these goods were of very superior quality, and would have received the premium, had the conditions of the proposal been complied with.

To James B. M'Fee and Groves & Fleming, of Philadelphia, an honorary mention is awarded, for their excellent samples of ticking; both very superior articles.

Honorary mention is also awarded to —— Clapp, Leicester, Mass. for 4 pieces mixed cloths, of excellent quality for the price, and to James M. Robbins, of Watertown, and Sheppard's woollen manufactory, Northampton, for 4 pieces blue, and 4 pieces black broadcloth, being the best exhibited. These cloths were not entitled to the premium, by the terms offered, there being a standing rule of the Institute, that no premium will be awarded, unless they are superior to any that have been heretofore presented. These cloths are represented by the judges, to be well made and substantial, of good fast colour, and handsomely dressed. It is but justice to remark, that the cloths heretofore exhibited, were sold at 10 and 11 dollars, while the above 8 pieces were offered at 7 dollars.

Honorary mention is also awarded to Magee & Tabor, for a set of gig harness, made by them, of splendid workmanship, unequalled by any the judges had ever seen. These gentlemen obtained a premium last year. Also, to Leadbeater & Sons, for a splendid hanging astral lamp, with four burners; a specimen of work highly creditable to them. The committee regret these gentlemen did not make it of a size to claim the premium, which the quality of the work would have entitled them to do.

The committee further award honorary mention, to William Rowland, of Philadelphia, for his very superior mill, pit, and cross cut saws, of excellent quality, well ground and finished.

The committee further beg leave, especially, to notice the Pharmaceutical preparations of G. W. Carpenter, whose improvements in the science of pharmacy, reflect great credit on him, and have proved highly useful to the public.

Also, the chemical preparations and colours from the Maryland Chemical Company, to whom our manufacturers are much indebted, for relieving them from a dependence on the importers, for articles which are indispensable. The bleaching salts was remarked as being of excellent quality, and preferred, by many, to the celebrated bleaching salt of Tennant, of Glasgow. Also, carbonate of magnesia, and calcined magnesia, made from the purest sulphate of magnesia, washed by steam, appeared nearly chemically pure; and many other specimens of equal quality.

Cast Iron Medals, from Jones, Keim & Co. Windsor Furnace, near Hamburg, Penn.; the most perfect specimens of castings known of this country's production, and rivalling the most splendid Berlin medals.

Fancy articles, from William Tait, Philadelphia, and Water Colours, from George C. Osborne, of Philadelphia, evinced much improvement in both branches of manufacture, and were highly creditable.

Of the Sole Leather, from Ashburner & Son, and W. & I. Pritchett, the committee take much pleasure in stating, that they were judged to be of the best of the kind, and fully sustain the character so long held by the Philadelphia tanners.

The committee would further particularly notice, Grates, from Lloyd & Son, —— Jackson, and —— Mifflin, all of which were well made and of good workmanship. The design of No. 132, from Lloyd's, was particularly pleasing.

Brass Hinges, &c. from William Garret, were adjudged well finished, and creditable articles.

The committee cannot close this report without tendering their thanks to the gentlemen who so ably fulfilled the arduous duties of the committee of arrangement. To them the Institute and public are indebted, for the splendid exhibition they have just witnessed; and to them much praise is due for the neat and careful manner in which the articles were displayed.

In closing the report of the Fifth Exhibition, the committee must again throw themselves on the indulgence of the public, to pardon any errors into which they may have fallen. If any injustice has

been done, they feel confident it will be attributed to causes without their control. The constant aim of the committee has been, equal justice and impartiality to all. They are aware that many articles, deserving special notice, have been omitted in this preliminary report. Respecting such they give the assurance, that in a few days, they will present a detailed report of all which were exhibited, with their respective merits.

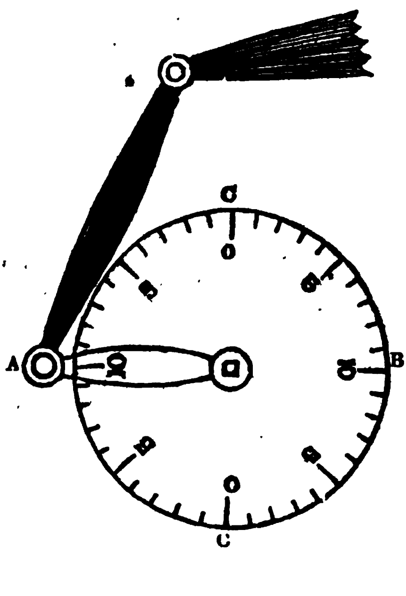
Saumel V. Merrick,
James Ronaldson,
Thos. Fletcher,
Adam Ramage,
M. W. Baldwin,
M. D. Lewis,
Isaiah Lukens,
Christian Gobrecht,
Committee on Premiums and Exhibitions.

Observations on the comparative difference in the effective power of Steam, as applied to the Rotary, and Reciprocating Engine.

TO THE EDITOR OF THE FRANKLIN JOURNAL.

Sir,—Having often enquired the difference in effect between a reciprocating engine and a rotary one, without being satisfactorily answered, I lately endeavoured to solve the problem myself. I have sent you the result of my labour: should my method of calculation be obscure, and the conclusion erroneous, I need only put you in mind, that you have promised to destroy, to correct, or to expunge, with tenderness, the communications of those who are less accustomed to handle a pen, than a

Hammer.



A reciprocating steam engine, whose cylinder is 2 feet long and one foot in diameter, will describe, by its crank, a circle 2 feet in diameter, which will require a double stroke of the piston, and so consume a column of steam 4 feet long and one foot in diameter; but the whole power of the steam will only be exerted at two points in the circle, viz. at A and B, and as the crank recedes from these, the power decreases till it reaches C, C, the dead points, where the steam is altogether of no avail; and on the contrary, as it approaches A, B, the power increases till it arrives at its maximum, at those places. Now let us suppose the circle divided as in

the diagram, then each figure will express the power of the engine at the time the crank is opposite to it: so, also, would the gross amount of all the figures united, express the power of the engine, during one revolution of the crank, or a double stroke of the piston: may we not state it thus?

Power 200 (the amount of figures) produced by a column of steam 4 feet by 1 foot.

Now suppose a rotative engine of the *same diameter as the circle which the crank above, describes,* (*viz.* 2 *feet*) *and the area of whose piston is the same as the one above-mentioned;* then, (leaving friction, &c. &c. out of the question) the force of such an engine would be the same in all points of the circle, as the reciprocating one at A and B; consequently, each figure would represent 10, and the whole united, 400, or just double the power produced by the reciprocating engine.

But then the quantity of steam consumed by the latter, will be considerably more than the former, viz. a column of steam 6.2832 the circumference by 1 foot: the account will then stand thus, the

Reciprocating engine, power 200, steam 4.
Rotary do. power 400, steam 6.2832.

then if 6.2832, the steam consumed in the rotary, produce power 400, what will 4, the steam used in the reciprocating one, produce? the answer is, 254; so that, if this calculation be not visionary, a rotative engine is to a reciprocating one, the quantity of steam consumed being equal, as 254 is to 200, or *one-fourth* more effective.

New York, October 21, 1828.

Remarks by the Editor.—The practical difficulties which have attended every plan hitherto attempted for constructing a rotary engine, seem to us to render any comparison between it and the reciprocating, a task of no easy performance. Which of the numerous rotary engines shall we adopt, as the subject for comparison? In some of them, condensation has been attempted; in others, the high pressure principle, without condensation, has been essayed; in all of them, the difficulties of packing, of constructing the valves, of letting the steam on and off, &c. &c. are sources of immense loss of power. The fact is, that a good rotary engine, or even one whose power can be calculated, is, in our opinion, a mere theoretical being, whilst the reciprocating can be correctly estimated. In a rotary engine, the steam is never cut off; in the reciprocating, it may, and ought to be, cut off long before the stroke of the piston is completed, depending upon the elasticity of the steam employed. These are mere hints, but we can give no more, as the subject would demand more time and space, than we have to spare.

Remarks on the article upon Perpetual Motion, in the last number of the Franklin Journal, by a Correspondent.

TO THE EDITOR OF THE FRANKLIN JOURNAL.

Sir,—I have been much gratified by the article in your Journal for November, on *Perpetual Motion*, because the information there given of some of the most plausible schemes for producing it, is, I think, equally with the demonstration of their futility, calculated to awake many active and ingenious minds from their day dreams, which, however, if they did not cause much loss of money or valuable time in the pursuit of an *ignis fatuus*, might be an innocent, and not always profitless amusement.

Great credit is often claimed for our countrymen's alleged superior ingenuity and inventive powers. I am not disposed to dispute the claim: it is at once accounted for in the peculiar circumstances of a new and thinly settled country, where every farmer is urged, by necessity, to contrivance for the supply of constantly recurring wants. This evidently conduces to form that character for acuteness and ingenuity, among our yeomanry, which would be seldom found on the farms, if in the workshops, of Europe. But that scientific and practical knowledge of mechanics, which is essential to the invention of a good machine, is equally rare among us. These two causes, both operate to produce, and are manifest in, the multifarious inventions and machines that crowd the shelves, and the records, of the patent office; and in the inquiry, why so very few of them, though new to the patentee, are, in reality, original and valuable, we shall, probably, find little to gratify our national pride; for I believe it must be allowed, that most of them evince a deficiency of mechanical science, or an ignorance of the progress made in it.

I desire not to depreciate the character of our nation for natural or acquired talent, but to show the need there is for more full and correct information to direct it usefully in the department of mechanics; and I believe the exhibition you have given of the futile attempts to produce a perpetual motion, will be useful as a corrective of the evil I have alluded to, and that it might be profitably extended to other subjects.

But even the pursuit after perpetual motion, hopeless as it is, may not be considered entirely vain. As an exercise of the mind and of the inventive faculties, it is not useless, as it may, occasionally, lead to useful modifications of machinery. As an instance of this, I here submit to you, a plan suggested by an ingenious friend of mine, several years ago, for projecting levers from the centre and on one side of wheels, which was new to me, and if so to you, may be considered worth insertion in the Journal, as an appendix to your remarks on perpetual motion.

The diagrams annexed, exhibit the plan, and need little explanation.

Fig. 1.

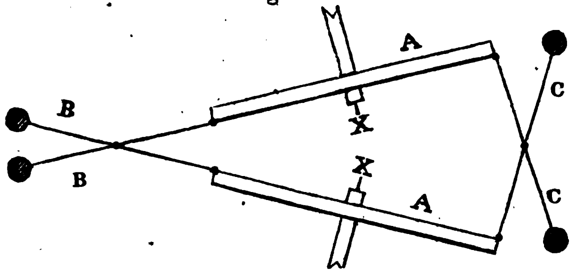
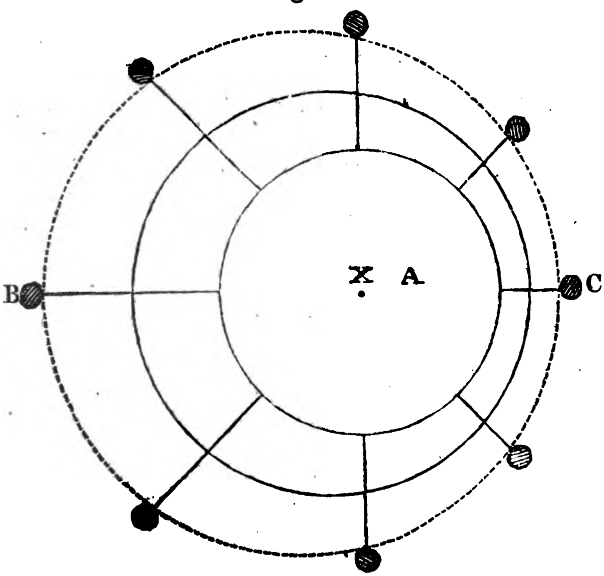


Fig. 1. is a perpendicular view. A, A, are two vertical wheels, placed diagonally, and revolving on the axes X, X. The levers or arms B, B, and C, C, are hinged at the peripheries of the wheels, and are jointed near their centres. By rotation of the wheels, the arms B, B, are projected from the centre of motion, while the arms C, C, are drawn in.

Fig. 2.



It is plain, that a series of arms, as shown in the horizontal view of one of the wheels, Fig. 2, will produce an eccentric motion, causing the weights at their ends, apparently, to preponderate on the side B. It is obvious, also, that a ring attached to the joints of the arms, would form an eccentric, applicable, perhaps, to some useful mechanical purpose. BELIDOR.

November 15, 1828.

Notice respecting Steam Carriages. By the Editor.

We have several times adverted to the subject of steam carriages, and have ever expressed the opinion that, upon ordinary roads, they will not be made to fulfil the conditions required, for the conveyance of passengers, or the transportation of goods. For the convenient and safe application of steam power, a degree of uniformity of motion is requisite, which we think it impossible to obtain, where there are considerable ascents and descents, stones, ruts, and other obstructions. We have inserted from the English Journals, several notices of attempts to overcome these difficulties, and we have continued to seek for all the intelligence that has been published upon the subject; but the articles which have come under our notice, have been so contradictory, that we were only likely to mislead our readers by their insertion. Of late, Gurney's steam carriage appears to have taken the lead, in arresting public attention, and some of the journalists have spoken of it as completely successful, whilst others have represented it as an experiment altogether unpromising in its character. In the London Journal of Arts and Sciences, the editors, Messrs. Newton and Partington, say, "to several inquiries as to the progress of the steam coach, we are compelled to reply, that there has not yet been any carriage exhibited, either publicly, or privately, which warrants us in saying that the object is likely to be effected." The proprietors, however, if we credit the representations published by them, or their friends, appear quite confident of success, and, indeed, claim to have already succeeded.

We have been presented by Turner Camac, Esq. of Philadelphia, with a large geometrical drawing of this carriage, (Gurney's) in plan and section. This drawing was brought over by Lieut. Col. Camac of the British army, a brother to the first named gentleman. We have conversed with the colonel, who had ridden a considerable distance in Gurney's carriage. This trial coach was sufficiently large to carry six passengers inside; besides these, there were eight persons on the outside; two of whom were employed in the management of the vehicle, the others were passengers. The general impressions of Colonel Camac, as regards the coach, are favourable, but he apprehends that the obstructions from rough, or deep roads, and steep ascents, will with difficulty be overcome, although on level and good roads, the travelling was pleasant and rapid.

In public trials of this description, it is not the wish, nor is it the business, of projectors, to be defeated in what they attempt, and the experiments are, therefore, made in the most favourable situations, where apparent perfect success is well calculated to lead a very large majority of the spectators into error; and this we apprehend has been the case in the present instance.

Much skill has, of course, been employed in the structure, as it has been long in hand, and under the direction of men of ingenuity, who have profited by their own observations, and those of others, as successive difficulties have been encountered. We do not, however, in the present state of our knowledge, think it necessary to give an

engraved representation of the engine and carriage. When it shall have carried passengers, in successive trips, on a route of twenty miles, where the usual varieties of hill and dale must have been encountered, its structure and merits shall be fully exhibited.

We will, at present, briefly remark, that the two steam cylinders, which work two cranks on the axle of the hind wheels, are placed under the fore part of the carriage; the boiler, which is tubular, is in the boot, behind, and is encased in such a way as to radiate but little heat; there is a tank below the carriage, for containing a supply of water; there are six wheels, the two foremost being turned by a handle, under the management of the guide, to direct the carriage. As a chimney of sufficient height, to procure the requisite draft, could not be used, a blower, or fan, with revolving vanes, is employed. To aid in ascending hills, there are propellers, which are to operate like poles in propelling a boat; and there is a drag, or brake, to regulate the velocity, in descending.

On Colouring Engravings, and on Coloured Inks.

TRANSLATED FOR THE FRANKLIN JOURNAL.

[From the *Journal des Connoisance Usuelles.*]

The art of colouring engravings, is very easily acquired, and can be practised by persons who are unacquainted with drawing. Only so much skill is necessary, in the commencement, as shall suffice for the imitation of good models; and a little practice will then give facility of execution, and improve the taste. As this art is very amusing to children, and furnishes an agreeable occupation to females, we extract from the *Encyclopedia Moderne*, some directions for its performance.

The colouring of books of engravings, and of those which ornament the volumes in our libraries, are usually executed by women; it consists in giving, by means of the pencil, that colouring to printed engravings, which shall correspond with the native hues of the objects represented. This art has, in modern times, arrived at great perfection, as may be seen in various beautiful collections of flowers and plants, which have been presented to us by those who have attained the greatest skill in this department. The magnificent collection of roses by Redouté; the medical Flora of the Antilles by Décourtils, and many others, might be cited as examples.

This colouring is a kind of bodiless painting, or rather of washed drawing; the tints employed, ought to be transparent, and thin; those which have the least body, are, therefore, chosen; or rather colours are preferred, which are without any, as those which are obtained from flowers, and which are found to be the most suitable for this kind of work. When it is necessary to take such as are more gross, they are repeatedly washed, so as eventually to procure the finer particles only.

The blue petals of the iris, afford a green fecula; but this, however, is less beautiful than that obtained from the ripe berries of

buckthorn, and which is called sap-green. The berries of the dwarf alder, afford a violet colour, which may be changed to blue, by the addition of alum. There are many other berries, which afford coloured juices; such as the gooseberry, the cherry, the raspberry, the seeds of madder, and the elder. A decoction of the woods is sometimes used, such as that of fustic, and of logwood. A yellow is prepared by gamboge and water; a crimson, by carmine and weak gum water; the colour of water, by verditer combined with cream of tartar; blue, by indigo and alum, or by Prussian blue; a fawn colour, by tormentil root; and black, by uniting sulphate of iron (copperas) with this last, or by using Indian ink.

All the coloured juices of which we have spoken, may be brought into the form of cakes; nothing more is necessary, but to add to them, when boiled, a portion of fish glue, and, afterwards, to allow them to dry in moulds made of card, which have been rubbed over with butter, or with grease, to prevent their adhesion; by this means, they acquire the consistence of Indian ink, and may be used in the same way.

These colours, when concentrated, may be employed as coloured inks. Among these, one only is in common use in commercial transactions, namely, red ink. Occasionally, green and yellow inks are used, and, sometimes, though more rarely, those of other colours. The following is the composition of some of these, which, when properly diluted, serve well for the colouring of engravings.

Red Ink.—The mode of preparing this ink, recommended by M. de Ribaucourt: infuse 4 ounces of ground Brazil wood in vinegar, for three days; then heat it to the boiling point, and keep it for an hour at that temperature, after which, it must be filtrated. Whilst hot, dissolve in it one-third of an ounce of gum arabic, and the same quantity of sugar, and of alum; allow it to cool, and put it into well stopped bottles.

An ink of a still more beautiful shade, may be made with a decoction of cochineal, to which ammonia is to be added.

The most beautiful of all the red inks, is made by a solution of carmine in liquid ammonia, allowing the excess of the alkali to evaporate, and adding a small portion of colourless gum arabic.

Green Ink.—Klaprotti's recipe for making a beautiful green ink, is the following: boil two parts of verdegris, and one of cream of tartar, in eight parts of water, until it is reduced to one-half. Strain it through a cloth, allow it to cool, and then bottle it.

Yellow Ink.—In a quart of boiling water, dissolve an ounce of alum; add half a pound of French berries, (*Graines d'Avignon;*) keep the mixture at the boiling point for an hour, strain the liquid, and dissolve in it a little more than a quarter of an ounce of gum arabic.

By following the same process, but substituting a much smaller quantity of saffron for the French berries, a much more beautiful yellow will be obtained. A still more durable colour may be made from gamboge, by merely dissolving it in water, until it is of the shade required.

By means of concentrated solutions of the greater number of colouring substances, inks of every shade may be prepared; a portion of gum is, in general, required, to suspend the colouring matter; and, sometimes, corrosive sublimate must be added to prevent mouldiness.

On an improved mode of heating Fluids, to make Vegetable Extracts, boil Sugar, raise high pressure Steam, &c.

Mr. G. R. Porter, in connexion with Mr. J. T. Beale, Engineer, of Church lane, Whitechapel, have just patented an invention, which promises to become of most extensive and beneficial use in the arts. It consists in the application of volatile fluids, such as the essential oil or spirit of turpentine, the spirit of coal tar, &c. which are put into a boiler, in which is also inserted another boiler, to contain the matter to be heated, and leaving a space beneath and around the inner vessel; an iron elbow pipe, of twenty feet in length, with a valve at top, opening upwards, is also inserted into the bottom of the external boiler. This apparatus is abundantly simple, and the arrangement considerably resembles the apparatus employed at Apothecaries' Hall, and other establishments, for making extracts, distilling, &c. by high-pressure steam; but with this very considerable advantage over the employment of steam, that, instead of running the risk of the steam-boiler bursting, as is too commonly the case, these volatile fluids, the instant they are volatilized by the action of the heat of the fire made under the boiler, on coming into contact with the inner vessel, are as instantly condensed, and fall back again in drops, or even in a small stream, to be reheated; at the same time giving off their heat most rapidly, to the fluid contained in the inner boiler. Nor has the volatile fluid any tendency to escape from between the two vessels, the iron elbow-pipe and valve being merely adopted as a measure of precaution, and the upper part of this pipe being hardly heated at all, when the apparatus is at work.

The Editor has lately seen an apparatus of this kind, at Messrs. Winstanley's, chemists, in the Poultry, making vegetable extracts; and although the extract then under process, had become thick, yet it continued boiling with considerable briskness, and without any danger of being scorched, at a temperature of 220°; the volatile fluid employed, being the spirit of coal tar.

We understand that a sugar-pan, or teache, is set up at Messrs. Pontifex's copper-works, in Whitechapel, where the process of boiling sugar under this new process, may be seen; and also that Mr. Beale employs it, at his engine manufactory, to generate high pressure steam for his rotary steam engine.

Several different degrees of temperature may be exactly maintained, by means of this new process, depending upon the temperature at which the essential oils have been distilled: thus we have

heard of one as high as between three and four hundred degrees; and of another which requires a degree of heat to volatilize it, as great as that required to melt zinc! [*Tech. Rep.*

On a singular Egyptian method of Ornamenting Wood.

The editor has lately been favoured by a friend returned from his travels in Egypt, with a part of a coarse comb, made of a dark brown coloured wood, and ornamented with brilliantly shining metallic figures, formed of circles and straight lines; and which, on examination, proved to be narrow grooves, filled up with an amalgam of mercury and tin in the crystallized state, such as is used in silvering looking-glasses; it just retaining a sufficient degree of consistency to remain in the grooves, and thus the brilliant metallic surface was continually renewed whenever the comb was rubbed, or wiped clean.

Other parts of it were ornamented with bits of thin green glass, with leaf brass laid beneath them, and let into shallow circular holes made in the comb to receive them.

The whole forms a curious specimen of rude and peculiar workmanship. [*ib.*

On ornamenting Wood in the Lathe.

Many years since, the editor was instructed in a method of ornamenting white wood in the lathe, and which he has never seen described in any of the numerous works published on the arts.

The method consists in forming a composition of shellac and rosin, to which various coloured powders are added, whilst the composition is in the melted state; such, for instance, as red-lead, vermilion, Prussian blue, indigo, king's yellow, yellow ochre, lamp-black, &c.; each colour being formed into a separate mass or ball, to be used in the following manner.

When the wood is turned into shape, and running swiftly round in the lathe, a ball of the desired colour is held against it, in the place desired to be coloured; the heat produced by the friction quickly melts a portion of the coloured mass, which adheres to the wood, and is then to be spread and diffused over its surface, and polished, by means of a piece of cork held against it. The edges of the coloured rings are then brought into an accurately defined shape by means of the turning tool; and then another colour may be applied to the wood in a similar manner, and so on, until the designed effect is produced.

We have frequently seen colours applied in a coarse manner to

wood in the lathe; these are, however, mixed in a softer composition, of which bees'-wax forms the chief part, and are by no means capable of being applied in the delicate manner above-mentioned.

Tunbridge ware may, no doubt, be thus ornamented in the lathe with considerable advantage. [*ib.*

LIST OF ENGLISH PATENTS.

List of Patents for New Inventions, which passed the Great Seal, from June 4th, to August 19th, 1828.

To Baron Charles Wetherstedt, for his invention of a liquid or composition for water-proofing or strengthening leather—June 4.

To Richard Witty, engineer, for his having invented or found out certain improvements in apparatus, for making and supplying coal gas for useful purposes—June 10.

To Edmond Gibson Atherley, Esq., for his having invented an apparatus, for a method of generating power applicable to various purposes—June 12.

To William Stratchan, manufacturer, for his having invented or found out an improvement in the making or manufacturing of alum—June 12.

To John Bartlett, shoe-thread manufacturer, for his invention of a new and improved method or methods, or manufacturing process, for preparing flax, thread, or yarn, for use in the manufacture of boots, shoes, saddlery, and of sails, and other cloths and bagging—June 16.

To George Johnson Young, iron founder, for his invention of a machine, whereby an additional and improved purchase or power will be given, in working ships' windlasses and capstans—June 21.

To Samuel Pratt, camp equipage maker, for his invention of certain improvements on elastic beds, cushions, seats, pads, and other articles of that kind—June 25.

To John Baring, merchant, in consequence of a communication made to him by a certain foreigner residing abroad, for an invention of a new and improved mode of making or manufacturing machines, for cutting fur from skins for the use of hatters, to be called "cant twist blades fur cutter"—July 3.

To John Johnston Isaac, engineer, for his invention of improvements in propelling vessels, boats, and other floating bodies—July 5.

To Thomas Revis, watchmaker, for his invention of an improved method of lifting weights—July 10.

To John Hawks, iron manufacturer, for his having found out and invented an improvement in the construction of ships' cable and hawser chains—July 10.

To John Henry Anthony Gunther, piano forte manufacturer, for his invention of certain improvements on piano fortes—July 10.

To William Muller, captain of our German legion, for his having

invented an instrument or apparatus, for the purpose of teaching or instructing in mathematical geography, astronomy, and other sciences, for the use of resolving problems in navigation, spherics, and other sciences—July 10.

To Benjamin Rider, hat tip manufacturer, for his invention of certain improvements in the manufacture of hats, which he intends to denominate Rider's patent hat tip—July 17.

To Joseph Jones, gentleman, for his invention of an improvement in certain parts of the process of smelting, or obtaining metallic copper from copper ore—July 17.

To Anton Bernhard, engineer, for a method, principle, or apparatus, for raising of water or other fluids—July 24.

To Robert Wornum, piano-forte maker, for certain improvements on upright piano-fortes—July 24.

To Joseph Clisild Daniell, clothier, for certain improvements applicable to the manufacturing and preparing of woollen cloth—August 5.

To John Lane Higgins, gentleman, for certain improvements on wheel carriages—August 11.

To William Mencke, gentleman, for certain improvements in preparing materials for, and in the making or manufacturing of bricks —August 11.

To Lewis Roper Fitzmaurice, master in the Royal navy, for improvements on ships' and other pumps, which improvements are also applicable by certain alterations to turning lathes and other purposes —August 11.

To William Grisenthwaite, Esq., for a new process for making sulphate of magnesia, commonly called epsom salts—August 11.

To Henry Maxwell, spur maker, for an improvement in spring spur sockets—August 13.

To Thomas Stirling, for certain improvements in filtering apparatus—August 16.

To Benjamin Matthew Payne, scale maker, for certain improvements on weighing machines—August 18.

To Edward Barnard, clothier, for certain improvements in weaving and preparing cloth—August 19.

To Philip Foxwell, clothier, William Clark, clothier, and Benjamin Clark, cloth-dresser, for certain improvements on machinery, for shearing, cropping, or cutting and finishing woollen, and other cloths and cassimeres.—August 19.

To William Sharp, cloth spinner, for certain improvements in machines for spinning or roving of cloth, silk, wool, or other fibrous substances—August 19.

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